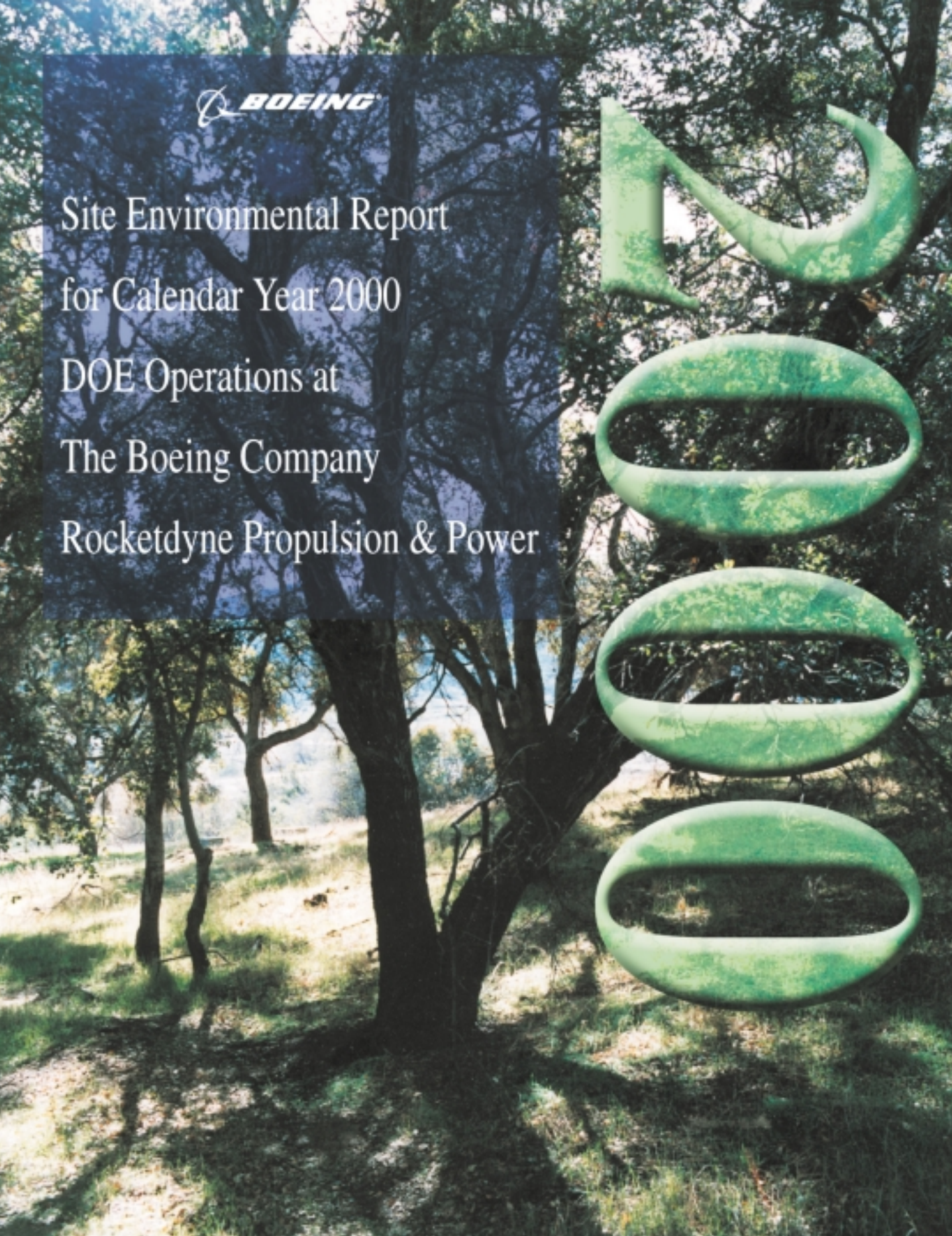
BOEING
Site Environmental Report
for Calendar Year 2000
DOE Operations at
The Boeing Company
Rocketdyne Propulsion & Power

Site Environmental Report for Calendar Year 2000 DOE Operations at The Boeing Company Rocketdyne Propulsion & Power

Prepared by the Staff of

The Boeing Company
Rocketdyne Propulsion & Power

September 2001

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CERTIFICATE OF ACCURACY

I certify that I have personally examined and am familiar with the information submitted herein and, based on inquiry of those individuals immediately responsible for preparing this report, I believe that the submitted information is true, accurate, and complete.

Majelle E. Lee
Program Manager
DOE Site Closure
The Boeing Company
Rocketdyne Propulsion & Power

September 10, 2001

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Department of Energy
Oakland Operations Office
1301 Clay Street
Oakland, California 94612-5208

SEP 1 0 2001

Subject: 2000 Site Environmental Report (SER) for the Energy Technology Engineering Center (ETEC)

To Whom It May Concern:

The Boeing Company Rocketdyne has prepared this report for the U.S. Department of Energy (DOE). It is a comprehensive summary of the Department's environmental protection activities at ETEC in Canoga Park, California for calendar year 2000. SERs are prepared annually for all DOE sites with significant environmental activities, and distributed to external regulatory agencies, interested organizations and individuals.

To the best of my knowledge, this report accurately summarizes the results of the 2000 environmental monitoring and restoration program at ETEC for DOE. This statement is based on reviews conducted by DOE Oakland Operations Office staff and by the staff of The Boeing Company.

A reader survey form is provided with this report to provide comments. Should you have any questions, please contact Michael Lopez, U.S. Department of Energy, (510) 637-1633.

Sincerely,

Henry M. De Graca, Director
Oakland Environmental Programs Division

Enclosure

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ACKNOWLEDGMENT

Preparation of this report has been a collaborative effort of many members of the Rocketdyne Safety, Health & Environmental Affairs (SHEA) Department.

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- Administrative assistance was provided by Pat Ohara.
- Publication assistance was provided by the staff of the Boeing Canoga Park Graphics & Publications Department.

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1. EXECUTIVE SUMMARY

This Annual Site Environmental Report (ASER) for 2000 describes the environmental conditions related to work performed for the Department of Energy (DOE) at Area IV of the Rocketdyne Santa Susana Field Laboratory (SSFL). In the past, these operations included development, fabrication, and disassembly of nuclear reactors, reactor fuel, and other radioactive materials, under the former Atomics International (AI) Division. Other activities included the operation of large-scale liquid metal facilities for testing of liquid metal fast breeder components at the Energy Technology Engineering Center (ETEC), a government-owned company-operated, test facility within Area IV. All nuclear work was terminated in 1988, and subsequently, all radiological work has been directed toward decontamination and decommissioning (D&D) of the previously used nuclear facilities and associated site areas. Large-scale D&D activities of the sodium test facilities began in 1996.

Results of the radiological monitoring program for the calendar year of 2000 continue to indicate no significant releases of radioactive material from Rocketdyne sites. All potential exposure pathways are sampled and/or monitored, including air, soil, surface water, groundwater, direct radiation, transfer of property (land, structures, waste), and recycling. All radioactive wastes are processed for disposal at DOE disposal sites and other sites approved by DOE and licensed for radioactive waste. Liquid radioactive wastes are not released into the environment and do not constitute an exposure pathway.

Calculated radiation doses to the public due to airborne releases and direct radiation are a factor of thousands to millions of times lower than the applicable limits as well as the naturally existing background levels. These theoretically calculated doses are too small to permit direct measurement. Conservative calculations provide upper-limit estimates of possible doses to the public. The radiation dose to a member of the public (maximally exposed individual) due to direct radiation from SSFL is indistinguishable from background. The maximum public dose due to airborne radioactivity released from SSFL facilities is estimated to be 7.7×10^{-7} mrem. These doses are far below the annual dose from natural indoor radon activity of about 200 mrem, and the total annual dose from all natural sources of about 300 mrem.

During 2000, 29 groundwater wells in Area IV were sampled and analyzed for radiological contaminants. Only naturally occurring radioactivity has been found in groundwater, except for low concentrations of tritium found in six wells, which are well below the Federal and State drinking water standards,

Currently, 47 on-site wells in Area IV of SSFL characterize the hydrogeology and water quality of known groundwater chemical contamination. These wells were analyzed for chemical and radiological constituents, as appropriate. Three interim groundwater remediation systems operated in Area IV during 2000, which were located at the Former Sodium Disposal Facility (FSDF), the Radioactive Material Handling Facility (RMHF), and Building 4059. In April 2000, operation of the interim system at the FSDF was stopped due to soil excavation at the site. Although trichloroethylene (TCE) was detected in these areas, no exposure to the public has occurred because no exposure pathways exist. These contaminated areas are being remediated. The interim treatment unit operated at Building 4059 also pumped water to keep the water table below the test vault in the building.

During 2000, 11 Area IV regulatory agency inspections, audits, and visits were conducted. These inspections were carried out by the California Department of Toxic Substances Control (DTSC), the California Department of Health Services Radiological Health Branch (DHS/RHB), the US Environment Protection Agency (EPA), and the Ventura County Air Pollution Control District (VCAPCD).

In summary, this Annual Site Environmental Report provides information showing that there are no indications of any potential impact on public health and safety because of the operations conducted at Area IV of SSFL. All measures and calculations of off-site conditions demonstrate compliance with applicable regulations, which provide for protection of human health and the environment.

This Annual Site Environmental Report was developed as required by DOE Orders 5400.1 and 231.1. In addition, this report summarizes information on environmental and effluent monitoring of DOE-sponsored activities to the regulatory agencies responsible for oversight. Information presented here focuses on Area IV at SSFL where DOE operations were performed. In addition, this report communicates to our workers, neighbors, and customers, factual information regarding the condition of our environment. To assist us in this effort, a reader response survey form has been included at the end of this report. We would appreciate your comments.

2. INTRODUCTION

This annual report describes the environmental monitoring program implemented by The Boeing Company Canoga Park (Rocketdyne) at its Santa Susana Field Laboratory (SSFL) facility located in Ventura County, California for calendar year 2000. Part of the SSFL facility, known as Area IV, had been used for the Department of Energy's (DOE) Energy Technology Engineering Center (ETEC) since the 1950s. A broad range of energy-related research and development (R&D) projects, including nuclear technologies, were conducted at the site. All the nuclear R&D operations in Area IV ceased in 1988, and the subsequent efforts have been directed toward decontamination and decommissioning (D&D) of the former nuclear facilities and closure of facilities used for liquid metal research.

Santa Susana Field Laboratory

The SSFL has been used for various research, development, and test projects funded by several U.S. government agencies, including DOE, Department of Defense (DOD), and National Aeronautics and Space Administration (NASA). The site consists of four administrative areas and undeveloped land. Figure 2-1 shows the arrangement of the site. Area IV has an area of about 290 acres.

In Area IV, starting in 1956, small test and demonstration reactors and critical assemblies were built and operated, reactor fuel elements were fabricated, and used fuel elements were disassembled and decladded. These projects were completed and terminated in the course of the next 30 years. Most of the work is described in detail in the Rocketdyne document "Nuclear Operations at Rockwell's Santa Susana Field Laboratory - A Factual Perspective" [Oldenkamp 1991]. The only work related to the nuclear operations since 1988 (and during 2000) was the ongoing cleanup and decontamination of the remaining inactive radiological facilities and the off-site disposal of radioactive waste.

The location of the SSFL site in relation to nearby communities is shown in Figure 2-2. Undeveloped land surrounds most of the SSFL site. No significant agricultural land use exists within 30 km (19 miles) of the SSFL site. While the land immediately surrounding Area IV is undeveloped, suburban residential areas are at greater distances. For example, 2.7 km (1.7 miles) northwest of Area IV is the closest residential portion of Simi Valley. The community of Santa Susana Knolls lies 4.8 km (3.0 miles) to the northeast. The Bell Canyon area begins approximately 2.3 km (1.4 miles) to the southeast, and the Brandeis-Bardin Institute is adjacent to the north.

Subdivisions			
Owner	**Jurisdiction**	**Acres**	**Subtotals**
Rocketdyne	Rocketdyne-Area IV	289.9	
	Rocketdyne	784.8	
	Rocketdyne (Undeveloped land)	1,324.6	2,399.3
Government	NASA (former AFP 57)	409.5	
	NASA (former AFP 64)	41.7	451.2
Total Acres			2,850.5

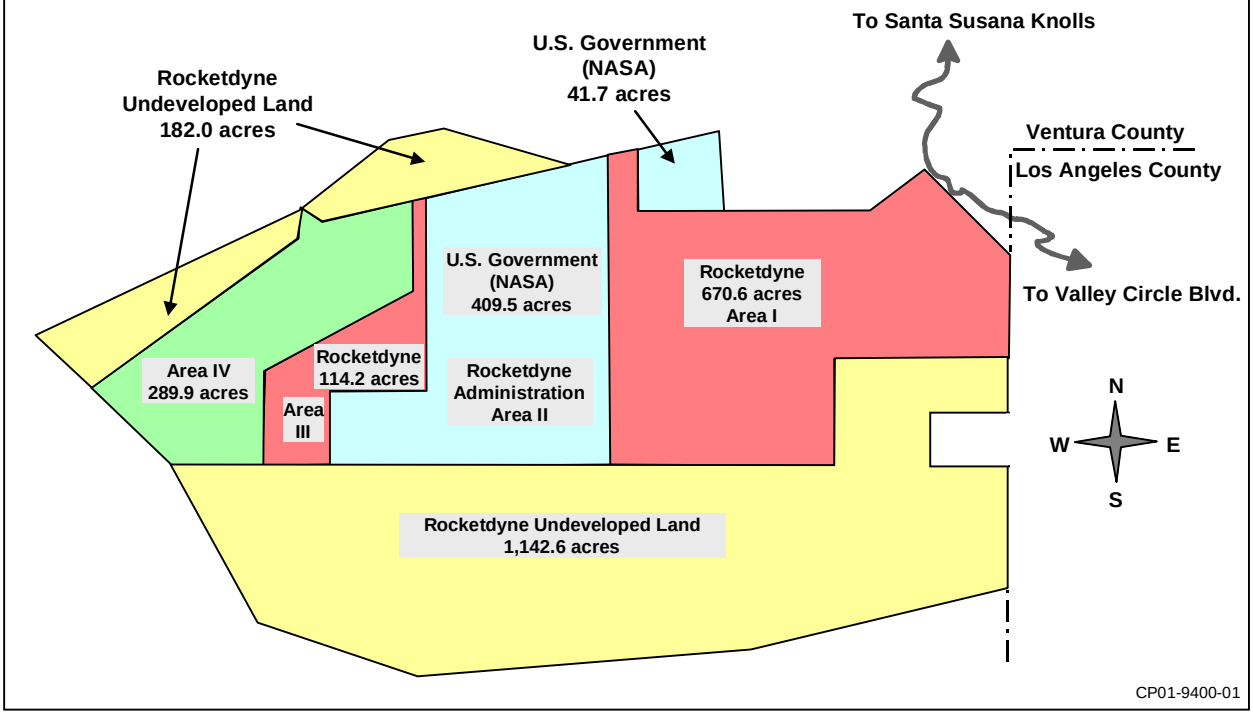

Figure 2-1. Santa Susana Field Laboratory Site Arrangement

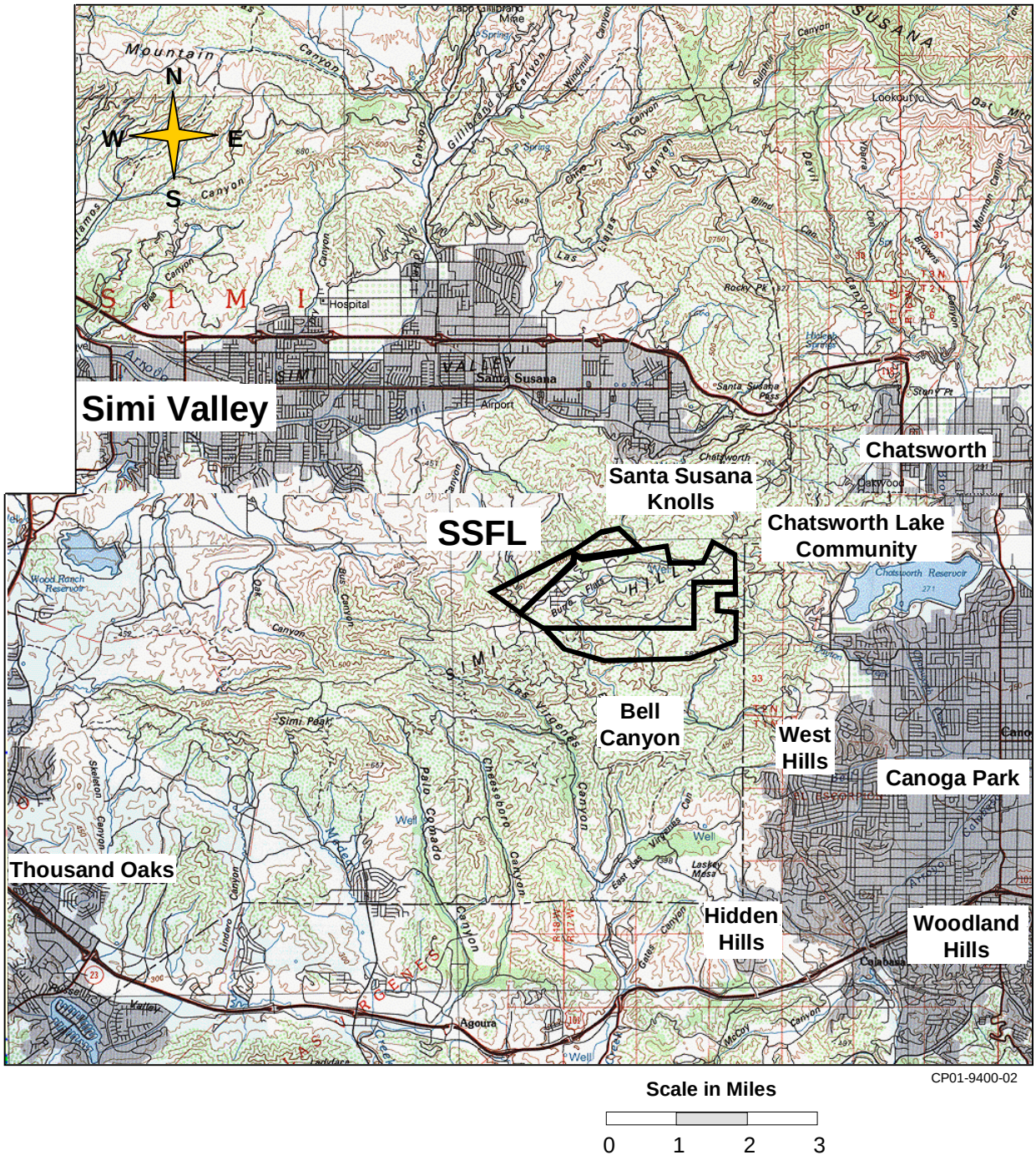

Figure 2-2. Map Showing Location of SSFL

The Los Angeles basin is a semiarid region whose climate is controlled primarily by the semi-permanent Pacific high-pressure cell that extends from Hawaii to the Southern California coast. The seasonal changes in the position of this cell greatly influence the weather conditions in this area. During the summer months, the high-pressure cell is displaced to the north. This results in mostly clear skies with little precipitation. During the winter, the cell moves sufficiently southward to allow some Pacific lows with their associated frontal systems to move into the area. This produces light to moderate precipitation with northerly and northwesterly winds.

During the summer, a shallow inversion layer generally exists in the Los Angeles area. The base and top of this inversion layer usually lie below the elevation of the SSFL site. Thus, any atmospheric release from the SSFL site during the summer would likely result in considerable atmospheric dispersion above the inversion layer prior to any diffusion through the inversion layer into the Simi or San Fernando Valleys. In the winter season, surface airflow is dominated by frontal activity moving easterly through the area. Storms passing through the area during the winter are generally accompanied by rainfall. Airborne mixing varies depending on the location of the weather front relative to the site. Generally, a light to moderate southwesterly wind precedes these storms, introducing a strong onshore flow of marine air and producing slightly unstable air. Wind speeds increase as the frontal systems approach, enhancing mixing and dispersion. Locally, average wind speeds range from 0 to 4.4 m/s (0 to 9.8 mph), mostly from the north and northwest.

Except for the Pacific Ocean, which is approximately 20 km (12 miles) south, no recreational body of water of noteworthy size is located in the surrounding area. Four major reservoirs providing domestic water to the greater Los Angeles area are located within 50 km (30 miles) of SSFL; the closest one to SSFL (Bard Reservoir, near the west end of Simi Valley) is more than 10 km (6 miles) from Area IV.

The SSFL site occupies 2,850 acres located in the Simi Hills of Ventura County, California, approximately 48 km (30 miles) northwest of downtown Los Angeles. The SSFL is situated on rugged terrain with elevations at the site varying from 500 to 700 m (1,650 to 2,250 ft) above sea level (ASL). Rocketdyne and DOE-owned facilities (Figures 2-3 and 2-4) share the Area IV portion of this site.

In 1998, DOE awarded Rocketdyne a contract for the closure of all DOE facilities in Area IV by 2006. Rocketdyne performs all the environmental remediation and restoration activities for the DOE.

Figure 2-3. Santa Susana Field Laboratory Site, Area IV

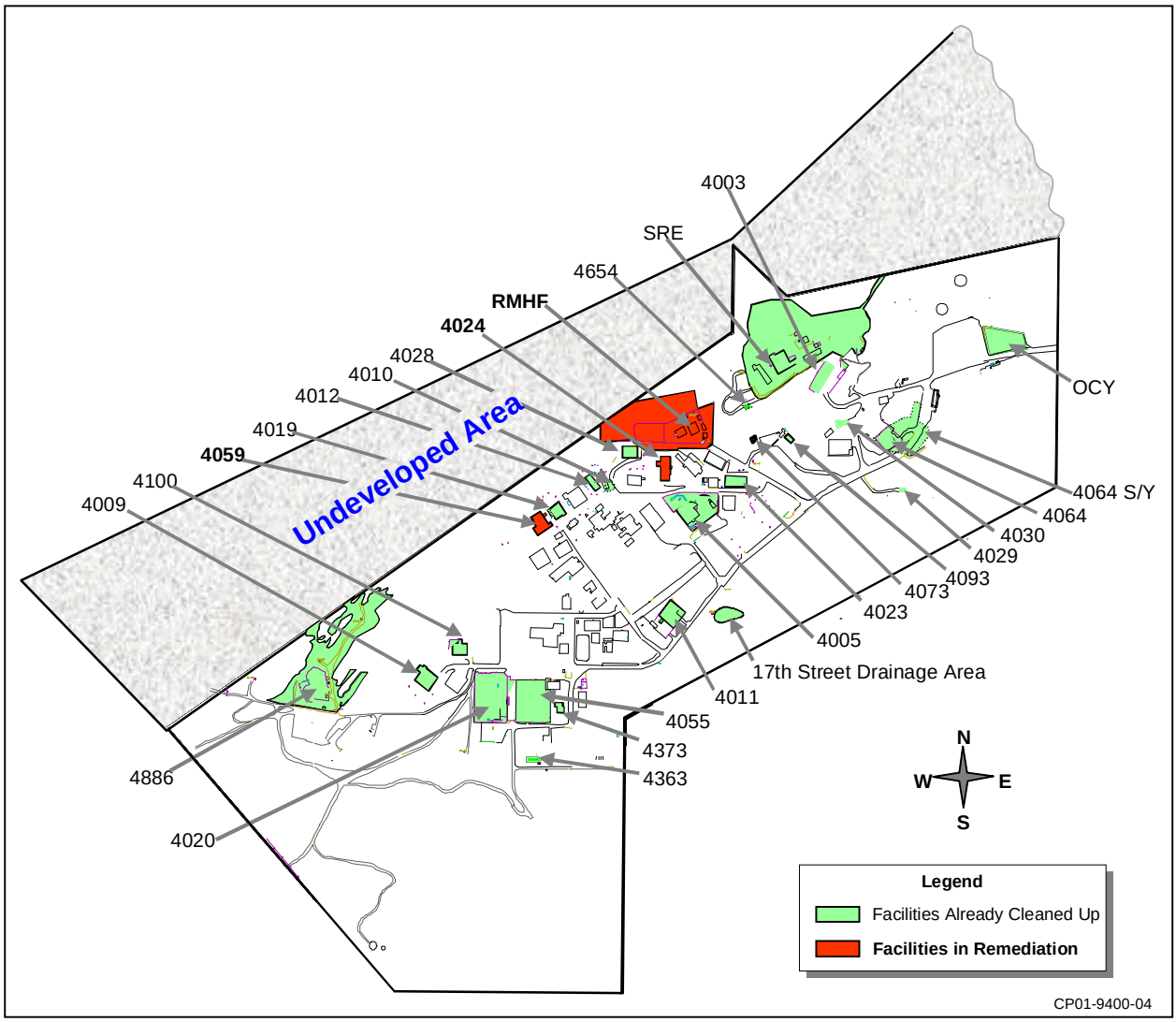

Figure 2-4. Map of Santa Susana Field Laboratory Area IV, Radiological Facilities

2.1 FACILITY DESCRIPTIONS

The following facilities in Area IV of SSFL are undergoing cleanup for radiological and chemical, primarily sodium, contaminants.

2.1.1 Radiological Facilities

Figure 2-4 shows a map of the legacy radiological facilities in Area IV. Three of these 28 facilities remain to be remediated.

Radioactive Materials Handling Facility (RMHF)

The RMHF complex consists of Buildings 4021, 4022, 4034, 4044, 4075, 4621, 4658, 4665, 4688, and drainage pond 4614. Operations at RMHF include processing, packaging, and temporary storage of radioactive waste materials, which are then shipped off-site to DOE-approved disposal facilities. Radioactive waste from decontamination operations contains uranium, transuranic elements such as plutonium, mixed fission products such as Cs-137 and Sr-90 and activation products such as Co-60, Eu-152, and tritium.

The Part B application submitted in 1999 was reviewed by the Department of Toxic Substances Control (DTSC). A revised permit application was submitted in July 2000 addressing issues raised by DTSC. Separate submittals were also made for the California Environmental Quality Act (CEQA) determination in support of the permit application. Significant issues addressed were the seismic evaluations for the facility and risk assessments for RMHF operations. These submittals are currently being reviewed by DTSC.

Work was initiated during 2000 to prepare the transuranic (TRU) waste for off-site shipment. Contact-handled waste drum D-109 was opened to remove a prohibited liquid-filled container, identified in previous computed tomography scans. The liquid was sampled for analysis and confirmed to be nonhazardous ALARA (as low as reasonably achievable) strippable paint. The remote-handled TRU waste stored in 1-gal paint cans in shielded storage drums, a component of the Hot Laboratory drain line residue waste stream, was overpacked in stainless steel containers for enhanced storage integrity and ease of future transfer from the storage drums to shipping drums. Randomly selected paint cans were sampled for chemical analysis as part of the TRU waste stream characterization. The TRU sludge remaining in the bottom of the former Building 4020 drain tank was also sampled as part of the characterization of the full drain line residue waste stream.

During 2000, atmospheric effluents were released through a stack as a result of the waste handling operations at the RMHF. The effluents were filtered and monitored before release into the atmosphere to ensure compliance with the National Emission Standards for Hazardous Air Pollutants (NESHAPs) requirements. No radioactive liquid effluents were released from the facility.

Groundwater was pumped and treated throughout 2000 as part of the interim groundwater remediation program. Approximately 298,500 gallons of trichloroethylene (TCE)-contaminated groundwater were pumped and treated at the RMHF Area Interim Extraction and Treatment System (ETS) in 2000.

Building 4059

Operations at Building 4059 during the early 1990s consisted of removal of activated steel and concrete as part of the D&D of this former Systems for Nuclear Auxiliary Power (SNAP) reactor ground test facility. Activation products consist primarily of Fe-55, Eu-152, and Co-60, and minimal amounts of H-3. No radiological work requiring ventilation was performed in the building in 2000, therefore no effluent monitoring was performed. A groundwater treatment system was installed in February 1998, and approximately 1,821,800 gallons of TCE-contaminated groundwater from Wells RD-24, 25, and 28 were processed in 2000.

Building 4024

Building 4024 houses two shielded vaults in its basement. During the 1960s, this building housed two experimental reactor systems. Following termination of the projects, all equipment and fuel was removed from the facility. The shielding concrete in the vaults currently contains low levels of activation products including Co-60 and Eu-152/154. This radioactivity is confined and the radiation levels inside the vaults are a fraction of a millirem/hour. The facility is scheduled for final decommissioning and demolition in the 2002-2004 time frame.

2.1.2 Former Sodium Facilities

The primary purpose of closure operations for former sodium facilities is the environmental restoration of SSFL areas and facilities that have been impacted by DOE operations. Sodium and related liquid metal test facilities were constructed at ETEC to support development testing of components for liquid metal electrical power production systems. The objective is to remove sodium and other hazardous materials from former sodium test facilities, dismantle the structural steel, concrete and utilities, and restore the land to previous conditions. The stainless steel sodium loops including the piping, equipment and structures are to be removed. Foundations, pits and utilities will be removed. The resultant earth voids will be backfilled and the former sodium facility sites restored.

Buildings 4355/4356 (SCTI)

The Sodium Components Test Installation (SCTI) includes Buildings 4355, 4356, 4357, 4358, 4359, 4360, 4361, and 4392. The complex consists of two adjoining test stands constructed of structural steel and concrete. Two steam generator test articles containing residual amounts of sodium are installed. Removal of sodium containing piping and components was completed in 2000. The steam generators were cleaned in situ using a Wet-Vapor-Nitrogen (WVN) process. The H-2 Sodium Heater tubing and piping were removed in 2000. Buildings 4359 and 4392 were demolished and the structural steel recycled.

Buildings 4026/4226/4826 (SCTL)

Buildings 4026, 4226, and 4826 comprised the Sodium Components Test Loop (SCTL) complex. This facility was used to test small components such as valves and pumps using liquid sodium flowing through stainless steel piping. All sodium-containing components were removed in previous years. In 1999, the WVN cleaning of sodium piping and components was completed. Sodium hydroxide generated from the WVN process was recycled and the clean steel was sold as

scrap. The facility was demolished and the steel recycled as scrap. The foundations, pits, and utilities were removed. At the end of 1999, a void remained where the concrete pits and foundations were removed. Back filling with soil was completed in 2000.

Former Sodium Disposal Facility (FSDF)

The Former Sodium Disposal Facility (FSDF) upper and lower ponds and surrounding areas work scope in 2000 included the excavation, replacement, and compaction of soil to restore the site to its original condition. Ongoing activities include continuing maintenance of the area, rainwater management and support of closure activities. State of California regulatory approval of the Interim Closure Plan was obtained in 2000. Removal of the remaining chemically contaminated soil, backfilling the site with clean soil and replacement of the vegetation to blend with the surrounding area was completed in 2000. Processing final closure with the regulatory agencies continues. Approximately 14,000 tons of soil were removed and shipped to an off-site disposal facility.

Chemical analyses of soil have indicated the continued presence of residual chemical contaminants in the upper basin, western area, and drainage channels. The contaminants of concern were polychlorinated biphenyls (PCBs), dioxins, and mercury. As a result, interim measures have been implemented after consultation with the DTSC, including establishment of sediment weirs downslope of the facility. A health-based risk assessment has been performed and was approved by DTSC on July 15, 1999. DTSC held a meeting on July 28, 1999 to receive public comment on the proposed workplan. Approval of the interim measure workplan was received and excavation of the chemically contaminated soil was initiated in April 2000. Field work was completed during November 2000. Field work included backfilling and grading with clean soil obtained from an on-site borrow site, installation of infiltration monitoring devices, and finally, seeding the site to restore natural vegetation. Off-site transport and disposal of the excavated soil commenced on January 22, 2001 and was completed on March 23, 2001.

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3. COMPLIANCE SUMMARY

This section summarizes Rocketdyne's compliance with federal, state, and local environmental regulations. Two main categories are presented: Section 3.1 discusses compliance status, and Section 3.2 discusses current issues and actions.

3.1 COMPLIANCE STATUS

A list of inspections, audits, and site visits by the various agencies overseeing the SSFL sites is given in Table 3-1. Following an inspection of the Radioactive Materials Handling Facility (RMHF) in January 2000, the Department of Toxic Substances Control (DTSC) issued an inspection report noting three violations, two of which were later withdrawn. The remaining violation relates to the failure to follow an inspection schedule. The violation was corrected and no fine was assessed.

Table 3-1. 2000 Agency Inspections/Visits Related to DOE Environmental Remediation

Date (2000)	Agency	Subject Area	Results
January	Environmental Protection Agency (EPA)	Conduct a fourth survey of buildings released for unrestricted use by DOE and DHS	Compliant
January	State of CA, DHS/RHB	Environmental thermoluminescent dosimeter (TLD) exchange	Compliant
January	Los Angeles County Department of Health Radiologic Branch	Review radiation safety program for radiation producing equipment	Compliant
January	DTSC	Annual compliance evaluation for the RMHF	NOV
April	State of CA, DHS/RHB	Environmental TLD exchange	Compliant
June	VCAPCD	Annual inspection of Permit to Operate (Permit 0271 and 5228) and reviewed usage logs for the 1999 compliance year	Compliant
July	State of CA, DHS/RHB	Environmental TLD exchange	Compliant
July	DTSC	Hazardous waste compliance inspection of the former Hazardous Waste Management Facility, Buildings 4133 and 4029, which are both undergoing closure	Compliant
October	State of CA, DHS/RHB	Environmental TLD exchange	Compliant
October	State of CA, DHS/RHB	Routine inspection of operations conducted under California Radioactive Materials License	Compliant
October	Environmental Protection Agency (EPA)	Conduct a fourth survey of Building 4059 for proposed 2-phase release and demolition	Compliant

3.1.1 Radiological

The results of radiological environmental monitoring indicate that the SSFL does not pose any significant radiological impact on the health and safety of the general public. All potential pathways are monitored including airborne, direct exposure, groundwater, surface water, waste disposal, and recycling (Sections 3.2.4 and 3.2.5).

3.1.1.1 Airborne Activity

Ventilation exhaust effluent from the RMHF is minimized by using high-efficiency particulate air (HEPA) filters. These effluents are continuously monitored by sampling the exhaust; their radioactive compositions are determined by radionuclide-specific analyses. The maximum off-site doses at the nearest residence from the effluent source are estimated by using the EPA computer program, CAP88-PC [EPA 1992].

For the airborne releases from the RMHF exhaust stack, the maximum individual annual exposure was estimated at 7.7×10^{-7} mrem/yr. This dose is significantly below the limit of 10 mrem/yr and the action level of 1% of the limit (0.1 mrem/yr) as specified in 40 CFR 61, the National Emission Standards for Hazardous Pollutants (NESHAPs) Subpart H (DOE facilities).

3.1.1.2 Groundwater

All liquid radioactive wastes are processed by either solidification or evaporation prior to disposal at DOE disposal sites. Liquid radioactive wastes are not released into the environment and do not constitute an exposure pathway. Groundwater and surface water in Area IV are sampled and analyzed to assure detection of any non-natural radioactivity.

There are 47 groundwater monitoring wells in and around Area IV. Groundwater is sampled and analyzed periodically for non-naturally occurring radionuclides. During 2000, no man-made radionuclides were found in the groundwater samples except for a few positive identifications of tritium. The positive tritium identifications had maximum concentrations of 317, 916, 2440, 200, 332, and 266 pCi/L at wells RD-24, RD-28, RD-34A, RD-34B, RD-54A and RD-63, respectively. The EPA's drinking water standard for tritium is 20,000 pCi/L. None of the groundwater in this area is used for human consumption.

Extracted groundwater from the French drain at Building 4059 is periodically sampled and analyzed by gamma spectroscopy. The purpose of this analysis is to detect any potential leakage of the activation products, namely Co-60 and Eu-152, from the underground reactor vault in Building 4059 to the groundwater. Since the French drain was dry in 2000, no water sample was taken for the year. In 1999, no man-made radionuclides were detected in the water samples.

3.1.1.3 Surface Water

Surface water from two National Pollutant Discharge Elimination System (NPDES) discharge points and five storm water runoff catch basins are also monitored routinely. The Rocketdyne NPDES permit allows excess water, such as reclaimed wastewater and runoff water from retention ponds due to heavy precipitation, to discharge into Bell Creek, a tributary to the Los Angeles River. Excess reclaimed water, including treated sanitary sewage and runoff from Area IV, is now discharged on a continuous basis through the R-2A outfall location (Outfall 002). Discharge along the northwest slope of Area IV (Outfalls 003 through 007) generally occurs only during and after periods of heavy rainfall. The permit applies the numerical limits for radioactivity in drinking water supplies to drainage through these outfalls. The permit requires radiological measurements of gross alpha, gross beta, tritium, and Sr-90. In 2000, 16 water samples were taken for NPDES permit compliance, no samples exceeded drinking water supplier limits for radioactivity.

3.1.1.4 Direct Radiation

The external exposure rate at Rocketdyne's northern property boundary, the closest property boundary to the RMHF, was indistinguishable from natural background. This property line is approximately 300 meters from the RMHF and separated by a sandstone ridge, effectively shielding the boundary from any direct radiation from the RMHF. Dosimeters placed on the RMHF side of this sandstone ridge, approximately 150 meters from the RMHF, read an average of 13 mrem/year above local background. This is considerably below DOE's 100 mrem/year limit.

3.1.2 Chemical

3.1.2.1 Resource Conservation and Recovery Act

The Resource Conservation and Recovery Act (RCRA) gives the Environmental Protection Agency (EPA) broad authority to regulate the handling, treatment, storage, and disposal of hazardous wastes. DOE owns and co-operates two RCRA-permitted treatment, storage, and disposal facilities with ETEC. Permit numbers are listed in Section 3.1.4.

3.1.2.1.1 RMHF

In 2000, the RMHF continued to operate as an Interim Status (Part A) permitted facility. This facility is used primarily for the handling and packaging of radioactive waste. Interim status is required for the storage and treatment of the small quantities of mixed waste (waste containing both hazardous and radioactive constituents) resulting from D&D activities at ETEC. The final disposition of mixed waste is addressed under the DOE and DTSC-approved Site Treatment Plan, which is authorized by the Federal Facilities Compliance Act (FFCA).

In July 1998, the California EPA DTSC requested the completion of the RCRA permitting process for RMHF. Completion of the RCRA permitting involves creating an Operations Plan document and following public comment and agency approval, the issuance of a Part B permit by the DTSC. A draft Operations Plan was submitted to DTSC in May 1999. In February 2000, the DTSC issued a Notice of Deficiency (NOD) for the Operation Plan. A response to the NOD was provided to the DTSC in May 2000.

3.1.2.1.2 HWMF

The Hazardous Waste Management Facility (HWMF) includes an inactive storage facility (Bldg 4029) and an inactive treatment facility (Bldg 4133) that was used for reactive metal waste such as sodium. In 1998, the facility entered final closure and is no longer operated. A closure plan was submitted to the DTSC in January 1999. The work performed in 2000 included processing of the RCRA Facility Closure Plan and coordination with regulatory agencies. Questions from the regulatory agencies were received and answered in 2000.

3.1.2.1.3 Sodium Removal

Removal of metallic sodium from the closed facilities continued and was completed in 2000. Removal of sodium is accomplished by bulk transfer and by conversion of metallic sodium into usable sodium hydroxide. The bulk sodium and piping residuals are managed as an

"excluded recyclable material" in accordance with applicable regulations. In 2000, approximately 8,750 pounds of surplus sodium were removed from Area IV. As of December 2000, approximately 200 pounds of surplus sodium were left for removal from components in storage. In addition to the surplus sodium, approximately 40,000 gallons of sodium are in use at the Sodium Pump Test Facility (SPTF) that is still in use for EM pump testing. The sodium in use will be removed from the SPTF site when the testing is completed.

3.1.2.1.4 RCRA Facility Investigation (RFI)

Under the Hazardous and Solid Waste Amendments of 1984, RCRA facilities can be brought into the corrective action process when an agency is considering any RCRA permit action for the facility. The SSFL was initially made subject to the corrective action process in 1989 by EPA, Region IX. The EPA has performed the Preliminary Assessment Report and the Visual Site Inspection portions of the RCRA Facility Assessment (RFA) process.

The State of California DTSC has RCRA authorization and has become the lead agency in implementing the corrective action process for the SSFL. ETEC has performed soil sampling at various Solid Waste Management Units (SWMU) and Areas of Concern (AOC) identified in the RFI Work Plan.

The current conditions report and a draft of the RFI Work Plan for the Area IV SWMUs were submitted to the DTSC in October 1993. In November 1996, DTSC approved a revised work plan addendum. During 2000, an amendment to the 1996 RFI Workplan was submitted to and approved by DTSC. This amendment added two DOE sites (Building 65-Metals Laboratory Clarifier and Building 457-Former Hazardous Materials Storage) to the RCRA RFI program. Fieldwork in areas of unrestricted use began in November 1996 and is scheduled for completion in 2002.

Fieldwork in 2000 included collecting soil samples from the Old Conservation Yard, B100 Trench, Building 65 Metals Laboratory Clarifier, Building 457, Former Hazardous Materials Storage, and Area IV leachfields. To date, approximately 22 soil vapor and 193 soil matrix samples have been collected and analyzed. The chemical analysis was performed by State-certified laboratories and validated by Ogden Environment, the RFI contractor. At DTSC's request, Boeing submitted the *RCRA Facility Preliminary Soil Sampling Results*, dated December 1999. The purpose of the submittal was to share RFI data (collected through December 1998) with DTSC in an effort to facilitate DTSCs review of the data and to share information with the public.

During 2000, a specific program of sampling to support the ecological risk assessments was performed. This sampling was conducted to collect the data necessary to estimate bioaccumulation factors (BAF) for certain contaminants found in the RFI sampling. These BAFs are the ratios of chemical concentrations in various environmental matrices (soil, water, sediment) to biological systems (plants, invertebrates, fish, mammals). These site-specific BAFs will be used to estimate potential ecological effects of contaminates to various levels of the eco-tropic system and are used in-place of literature BAF values, which are not site-specific.

In addition, Boeing received DTSC approval of the Standardized Risk Assessment Methodology (SRAM). The SRAM provides a standard approach to conducting risk assessments and also establishes background concentrations of naturally occurring chemicals in soils.

3.1.2.1.5 Groundwater

Characterization of the groundwater at the site continues. TCE continued to be detected in three areas of Area IV during 2000. The high concentrations were detected in three areas inside the northwestern property boundary, as shown in the shaded areas in Figure 6-3. Detailed TCE results are provided in Section 6.3.

3.1.2.2 Federal Facilities Compliance Act

Boeing is managing the DOE's modest inventory (approximately 17 m^3) of RCRA mixed wastes, at ETEC, in accordance with FFCA-mandated Site Treatment Plan (STP) approved in Ocober 1995. The inventory includes both mixed low-level wastes (MLLW) and mixed Transuranic wastes (MTRU). All mixed wastes that require on-site storage beyond the regulatory (i.e., per RCRA) allowed time limits are managed within the framework of the STP. Characterization, treatment, and disposal plans for each of several different wastes streams are defined in the STP with enforceable milestones. These include characterization, reporting, study of treatment options, shipping schedules, and actual removal. During CY 2000 shipment of 2 m^3 of mixed wastes to an off-site facility for treatment and disposal was accomplished. Management of the mixed waste has been in full compliance with the STP. Regular updates to reflect changes in inventory or status of mixed wastes and certifications of milestone completion are submitted to DTSC in accordance with the STP.

3.1.2.3 National Environmental Policy Act

The National Environmental Policy Act (NEPA) establishes a national policy to ensure that consideration is given to environmental factors in federal planning and decision-making. For those projects or actions expected to either affect the quality of the human environment or create controversy on environmental grounds, DOE requires that appropriate NEPA actions (Categorical Exclusion [CX], Environmental Assessment [EA], Finding of No Significant Impact [FONSI], or Notice of Intent [NOI], draft Environmental Impact Statement [EIS], final EIS, and Record of Decision [ROD]) have been incorporated into project planning documents. DOE has implemented NEPA as defined in Federal Register Volume 57, Number 80, pages 15122 through 15199 and in accordance with the DOE Order 451.1A.

An NOI was published in the Federal Register on September 15, 2000 announcing DOE intention to prepare an Environmental Assessment document. The Environmental Assessment will analyze the potential environmental impacts associated with environmental restoration and waste management activities for closure of the ETEC site. Public meetings to hear issues to be considered in the scope of the EA for the remaining restoration project were held on October 17 and 18, 2000. Written public comments were also invited. The Draft Environmental Assessment is anticipated to be completed in FY2001 followed by a public comment period.

No actions were taken by local authorities and no Notices of Violation (NOV) were relative to the Comprehensive Environmental Response, Compensation, and Liability Act

(CERCLA)/Superfund Amendments and Reauthorization Act (SARA) activities for the DOE area.

3.1.2.4 Clean Air Act

The Clean Air Act (CAA) resulted in federal regulations that set air quality standards and required state implementation plans (SIP). National Emissions Standards for Hazardous Air Pollutants (NESHAPs), New Source Performance Standards (NSPS), and monitoring programs in an effort to achieve air quality levels beneficial to the public health and welfare. The SSFL is regulated by the Ventura County Air Pollution Control District (VCAPCD) and must comply with VCAPCD Rules and Regulations. The EPA can enforce VCAPCD Rules and also regulates pollutants such as Ozone Depleting Substances (ODS) under 40 CFR 82. VCAPCD Rules and Regulations incorporate, by reference, NESHAPs regulations as codified under the CAA.

3.1.2.5 Clean Water Act

The Clean Water Act (CWA) is the primary authority for water pollution control programs, including the National Pollutant Discharge Elimination System (NPDES) permit program. The NPDES program regulates point source discharges of surface water to drainage channels (i.e., to locations other than sewage systems), and the discharge of storm water runoff associated with industrial activities. Basin Plan water quality objectives are one aspect applied as effluent standards for off-site discharge of storm and industrial wastewater via the SSFL water reclamation system.

Surface water discharges from SSFL are regulated under the California Water Code (Division 7) as administered by the California Regional Water Quality Control Board (CRWQCB). The existing NPDES Permit (CA0001309) for SSFL, which was revised and became effective June 29, 1998, is expected to remain in force through May 10, 2003. The revised NPDES Permit incorporated the General Permit (No. CAS000001) for storm water, which includes the requirement for a site-wide Storm Water Pollution Prevention Plan (SWPPP). The SWPPP is revised as needed and includes by reference many existing pollution prevention plans, policies, and procedures implemented at the SSFL site. Several key elements of the plan, including maps, are continually updated. Another key element is the Rocketdyne procedure "SSFL Storm Water Pollution Prevention Requirements." The Spill Prevention Control and Countermeasure (SPCC) plan serves to identify specific procedures for handling oil and hazardous substances to prevent uncontrolled discharge into or upon the navigable waters of the State of California or the United States. The U.S. EPA requires the preparation of an SPCC plan by those facilities that, because of their location, could reasonably be expected to discharge oil in harmful quantities into or upon navigable waters. A revised SPCC plan was submitted as a part of the revised Spill Prevention and Response Plan to the local Administering Agency on March 20, 2000.

Sewage from Area IV (including DOE facilities) is treated at the Area III Sewage Treatment Plant (STP), which discharges to the R2A Pond. Most surface runoff from Area IV also drains to R2A Pond. The monitored northwest slope of Area IV drains through five small catch basins. During periods of rainfall, and when there is adequate runoff for sampling, grab samples of surface water runoff are collected at the outfalls. Samples are collected no more than twice a month (biweekly) per outfall during the rainy season. In the dry season, if discharges

occur on a continual basis, samples are collected monthly. The sampling performed at the five northwest slope locations includes quarterly monitoring for a list of analyses referred to as "priority pollutants." There were no NOVs of the NPDES permit in 2000.

3.1.3 Public Participation

During 2000, Rocketdyne has continued and expanded its commitment to community involvement by hosting three homeowners association and community meetings and three bus tours at the Santa Susana Field Laboratory (SSFL). These activities provided a two-way exchange of information for more than 300 community members. Rocketdyne staff members and technical experts were on hand with display boards and exhibits to enhance understanding of the technological and scientific mission at SSFL as well as all environmental programs at the facility. Surveys indicated a very positive response to these meetings and the sharing of information. Rocketdyne also supported six regulatory agency-sponsored meetings as well as five meetings with local elected officials. During 2000, Rocketdyne also received approximately 15 visits from news media including NBC, LA Times, LA Weekly, Simi Star, Daily News, and Dallas Morning News.

Rocketdyne produced and distributed two fact sheets -- Santa Susana Field Laboratory: Radiological Cleanup and Monitoring Program and Santa Susana Field Laboratory: Soil Investigation and Cleanup -- and three community newsletters.

In addition to these efforts, Rocketdyne partnered with Friends of the Los Angeles River for the 11th Annual Great Los Angeles River Clean-up; the City of Los Angeles for the Countywide Household Hazardous Waste Collection Program – "Hazmobile" event; and two local elementary schools and grocers for Earth Day 2000.

In support of Rocketdyne's Educational Outreach program, the SSFL Council hosts several teacher and student tours each year at the field lab. The tours provide an opportunity for the teachers and students to see the historical site and talk to scientists and engineers involved in field lab programs.

Rocketdyne continues to supply three local repositories with information on environmental remediation projects at the site. In addition, Rocketdyne catalogues and inventories the documents at two of these repositories.

Rocketdyne maintains a community mailing list of about 1,600 people and distributed information to these community members as part of our ongoing community outreach activities and on behalf of the regulatory agencies.

3.1.4 Permits and Licenses (Area IV)

Listed below are the permits and licenses applicable to activities in Area IV[1].

Permit/License	Facility	Valid
Air (VCAPCD)		
Permit 0271	Combined permit renewal	1/1/98 through 12/31/00
Treatment Storage (EPA)		
CAD000629972 (93-3-TS-002)	Hazardous Waste Management Facility (T133 and T029)	Inactive: closure announced
CA3890090001	Radioactive Materials Handling Facility (RMHF)	Part A interim status Application for Part B submitted May 1999.
NPDES (CRWQCB)		
CA0001309	Santa Susana Field Laboratory	6/29/98 through 5/10/03
State of California		
Radioactive Materials License (0015-19)	All Rocketdyne facilities	Amendment Issued 104 3/2/00 105 1/31/01

During 2000, five underground storage tanks (UST) were exempt from permitting in Area IV. Table 3-2 shows a list of these tanks.

Table 3-2. SSFL Current Underground Storage Tanks

UST	Building Location	Capacity (gallons)	Tank Type	Contents
UT-7	T022	3,000	Stainless Steel Vaulted	RA water[a]
UT-15	T022	8,000	Stainless Steel Vaulted	RA water[a]
UT-16	T021	200	Stainless Steel Vaulted	RA water[a]
UT-34	T462	36,000	Stainless Steel Vaulted	Sodium[b]
UT-35	T462	34,000	Stainless Steel Vaulted	Sodium[b]

a: Radioactive (RA) water tanks are regulated by U.S. Department of Energy (DOE).
b: Sodium tanks are exempt from UST permitting per Ventura County Environmental Health Division.

[1]The waste discharge requirements for the sewage treatment plan in Area III that receives the Area IV sewage are included in the NPDES permit.

3.2 CURRENT ISSUES AND ACTIONS

3.2.1 Progress in Radiological Decommissioning Operations

3.2.1.1 2000 Status of Building Release

In 2000, neither DOE nor the State Department of Health Services Radiologic Health Branch (DHS/RHB) released any buildings for unrestricted use.

Certification dockets containing D&D and radiological survey reports were sent to DOE/Oakland for Building 4020 and the 17th Street Drainage Yard. Currently Rocketdyne is awaiting DOE and DHS action on the release for unrestricted use of Buildings 4020, 4019, 4059 (Phase I), 4064 Side Yard, and 4654. Rocketdyne is awaiting DHS action on the release for unrestricted use of the 17th Drainage Area.

3.2.1.2 2000 Status of Radiological Release Surveys

3.2.1.2.1 Area 4020 (Hot Lab)

In October 2000, Rocketdyne published its final status survey report on the land associated with the former Building 4020 [Liddy 2000a]. The report concluded that DOE and DHS approved release criteria were met and that the land was suitable for unrestricted use.

In December 2000, the Oak Ridge Institute of Science and Education (ORISE) published their verification survey report on the land associated with the former Building 4020 [ORISE 2000a]. The report concluded that,

> "The independent verification survey results for the residual radionuclide concentrations in soil and the exposure rates were less than the guideline levels. The verification survey findings, therefore, support Rocketdyne's final status survey conclusion, that the radiological conditions of the former Rockwell International Hot Laboratory site satisfy the DOE guidelines for release without radiological restrictions."

3.2.1.2.2 Building 4059 (SNAP Test Facility)

In October and December 2000, the EPA contractor, Tetra-Tech, performed a radiological survey of the Phase I portions of Building 4059. This follows final surveys performed by Rocketdyne in June 1999, and verification surveys performed by DHS and ORISE in October 1999 (see below). Media members and the public attended the survey activities as observers. Preliminary indications are that no surface contamination exceeding regulatory limits was found by either instruments or wipes. Rocketdyne is awaiting the EPA/Tetra-Tech report on this survey.

In December 2000, the ORISE published their verification survey report on Phase I of Building 4059 [ORISE 2000b]. The report concluded that the facility satisfied DOE and DHS approved release criteria.

The demolition of the Phase I portion of Building 4059 had been planned for the summer of 2000, but has been put on hold pending completion of the EA process (Section 3.1.2.3). Once

the Phase I portion of the building is released for unrestricted use, the remaining activated concrete in the underground test vault will then be removed and disposed of as radioactive waste (Phase II). The remaining hole will then be soil sampled by Rocketdyne as part of a final survey; and ORISE and DHS will then perform verification soil sampling. Assuming results show no residual contamination, the facility will be released for unrestricted use and the excavation back-filled and graded.

3.2.1.2.3 17th Street Drainage Area

The 17th Street Drainage Area was a bermed pond used to control surface water runoff from Area IV during the 1960s. In March 2000, Rocketdyne published Revision A of its final status survey report on the 17th Street Drainage Area [Liddy 2000b]. The report concluded that DOE and DHS approved release criteria were met and that the land was suitable for unrestricted use.

In April 2000, ORISE published its verification survey report on the 17th Street Drainage Area [ORISE 2000c]. The report concluded that,

> "The independent verification survey results indicate that soil concentrations for the 17th street Drainage Area satisfied the applicable site-specific soil guidelines. In addition, exposure rates were comparable to background levels and satisfied both the DOE and the more restrictive exposure rate guideline that Rocketdyne has elected to use. The verification survey findings, therefore, support Rocketdyne's final status survey conclusion, that 17th Street Drainage Area radiological conditions satisfy the guidelines for release without radiological restrictions."

3.2.1.2.4 Building 4133 (Hazardous Waste Management Facility - HWMF)

The HWMF is a permitted hazardous waste treatment facility that was used for treating metallic sodium and NaK and converting into NaOH and KOH. A work-plan for closure of this facility is currently being reviewed by the Department of Toxic Substances Control (DTSC). The HWMF was not operated as a radiological facility and radioactive materials were not used at the HWMF.

However, because of the HWMF functioned as a sodium treatment facility in Area IV of SSFL, it was determined that a complete radiation survey would be performed of the facility building, fenced land, and two acres of surrounding land. This would allow the permitted facility closure process to proceed without further concern for radiological constituents. This survey [Liddy 2001] included measurements for total and removable surface contamination of facility surfaces, radiation exposure measurements of land surfaces, radiation exposure measurements at 1 meter, and soil samples at surface and at depth. The survey demonstrated that the facility contained no detectable activity above background. The survey further demonstrated that soil surrounding the facility met DOE and DHS approved cleanup standards.

In April 2000, ORISE published its verification survey report on Building 4133 [ORISE 2000d]. The report concluded that,

> "All total and removable surface activity levels satisfied the DOE average and maximum guidelines for release for unrestricted use. All soil samples and exposure rate measurements were less than the guideline levels. The ESSAP survey results therefore, verify the Rocketdyne conclusion that Building 4133 satisfies the criteria for release for unrestricted use."

3.2.1.2.5 Building Surveys by EPA

In addition to the EPA survey of Building 4059 (Section 3.2.1.2.2), Rocketdyne permitted EPA to re-survey several prior released radiological buildings in January 2000: Buildings 4012, 4029, and 4363. A contractor for EPA, Tetra-Tech, performed these surveys. EPA and DOE invited the public, the media, and legislators' staffers to observe these surveys. The EPA inspection verified prior surveys, indicating the buildings are safe for unrestricted use. Rocketdyne is still awaiting the EPA report on this activity.

As part of the same EPA program, Rocketdyne has transmitted to EPA, survey and release documentation for a further five prior radiological buildings: 4009, 4011, 4019, 4055, and 4100. EPA has scheduled visits in August 2001 to perform surveys of Buildings 4011, 4019, 4055, and 4100. Of these buildings only Building 4019 is DOE-owned.

3.2.2 DTSC Report

In October 1999, the Cal/EPA Department of Toxic Substances Control (DTSC) released its report of an inquiry into the California Department of Health Services (DHS). The report is entitled "Rocketdyne Inquiry" and dated August 1999. The inquiry was conducted under the direction of Special Assistant Harold Thomas and Chief Investigator Mary Locke.

As part of the inquiry, a technical review of all DHS SSFL cancer registry studies was conducted by Dr. Myrto Petreas of DTSC's Hazardous Materials Laboratory under the direction of Dr. Bob Stevens, Deputy Director of DTSC's Science, Pollution and Prevention and Technology Program. This review was entitled "Health Studies at Santa Susana Field Laboratory - Expert Panel Review." Expert panel members, with no affiliation to DHS, were selected to review all previous SSFL cancer registry studies. These panel members were Dr. James Beaumont, Associate Professor at the Department of Epidemiology and Preventive Medicine at the UC Davis School of Medicine, and Dr. Faith Davis, Professor and Director, Division of Epidemiology and Biostatistics, School of Public Health at the University of Illinois, Chicago.

Extracts (in quotation marks and italics) of both the Expert Panel Review and the Rocketdyne Inquiry are provided below.

Health Studies at SSFL—Expert Panel Review

- "*Three studies of cancer incidence in the vicinity of SSFL were reviewed. Whereas there were some differences in the geographic areas, time periods, case definitions and level of significance used in these three studies, the combined*

evidence from all three does not indicate an increased rate of cancer incidence in the regions examined. The extremely modest cancer incidence increases associated with known radiosensitive tumors could be easily explained by uncontrolled confounding or imprecision of the data. The results do not support the presence of any major environmental hazard."

Rocketdyne Inquiry—a report by DTSC

- "*In 1992, DHS Environmental Epidemiology and Geographical Information Section Chief, Dr. Peggy Reynolds, DHS Cancer Surveillance Section staff (Carin Perkins) and the local Los Angeles Cancer Registry, through Leslie Berstein, followed up the 1990 study with a new inquiry entitled, "Cancer Incidence Near the Santa Susana Field Laboratory 1978-1989." The study concluded, "Analysis suggests that people living near the SSFL are not at increased risk for developing cancers associated with radiation exposure."*
- "*The public health epidemiological community does not today view the Rocketdyne data as significant or elevated enough to justify a major commitment of state resources. This point is reiterated in the conclusions of the report entitled "Health Studies at Santa Susana Field Laboratory - Expert Panel Review" (June 1999) when the independent reviewers sponsored by DTSC's Hazardous Material Laboratory concluded that the results of their data review did not support the presence of any major environmental hazard."*

3.2.3 Agency for Toxic Substances and Disease Registry (ATSDR)

In 1999, the Agency for Toxic Substances and Disease Registry (ATSDR) conducted an environmental review of the SSFL and surrounding community to determine the potential for significant off-site impacts. Their report, released on November 15, 1999, contained the following preliminary findings (quoted from the report).

- "*Available data provide no indication that municipal and privately owned water wells have been affected by chemicals from the site."*
- "*There is currently no indication that off-site residential areas have been adversely impacted by materials from the site."*
- "*Based on our initial review of existing data on possible pathways of exposure from the site, we have not seen that people in local communities have been exposed to substances from the site at levels that would result in adverse health effects."*

The complete ATSDR report documenting ATSDR's conclusions regarding Santa Susana may be found on the web at http://www.atsdr.cdc.gov/HAC/PHA/santa/san_toc.html.

To further confirm these findings, the ATSDR recommended the following three further activities:

- To re-evaluate the potential for community exposure considering additional assessment of airborne chemical releases and dispersion and contaminant migration in groundwater.
- Reanalysis of cancer registry data for census tracks surrounding the SSFL
- Further education of the community about the SSFL and ATSDR activities.

In 2000, ATSDR contracted with ERG, a consulting firm located in Massachusetts, to oversee the completion of these three tasks. ERG, in turn, hired several professors from the University of California at Los Angeles (UCLA) to perform this work. The UCLA team includes Dr. Yorem Cohen (environmental fate), Dr. Hal Morgenstern (cancer registry), and Dr. Deborah Glik (community education). ATSDR, ERG, and UCLA held a public meeting to announce the commencement of the follow-on work. Two meetings between Boeing, ATSDR, ERG, and UCLA were held in 2000 to kick off the study. Dr. Thomas Harmon, a co-worker of Dr. Cohen, visited SSFL to view groundwater monitoring well installation. The UCLA work began in 2000 and is planned to be completed in approximately 3 years.

3.2.4 Building Demolition and Disposal

Following the EPA survey of buildings in January 2000 (Section 3.2.1.2.5), questions were raised about the safety of disposing of building debris from released buildings to municipal sanitary landfills. Similar questions were raised relative to the recycling of metal from released buildings

The legal process of "releasing a building for unrestricted use" means that,

- Cleanup standards have been met (the EPA verified that remaining buildings were cleaned to levels, orders of magnitude lower than that which regulations permit).
- The regulatory agency imposes no further radiological controls or regulatory oversight for the building.
- The regulatory agency removes the building from the existing "Radioactive Material License"
- The building can be safely used for any other purposes without any further radiological controls.
- The building can be safely demolished and disposed of at regular landfills without any further radiological controls.
- Any other material from the building, including metal, can be safely reused or recycled without any further radiological controls.

In summary, Rocketdyne has complied with regulations, and there is no hazard from demolished building debris. The process of building release and ultimate disposal is no different from that used at other DOE and Nuclear Regulatory Commission (NRC) radiological facilities across the nation.

To further respond to these concerns, dose and risk analyses were performed for various buildings that were the subject of the EPA survey. Selected results are shown below.

Table 3-3 shows dose and risk to an employee working in Building 4012, which has been released for unrestricted use, for several different assumptions. RESRAD-Build was used for this analysis.

Table 3-4 shows the dose and risk to the public from building debris from Building 4028 disposed of at a municipal landfill using conservative assumptions. IMPACTS was used for this analysis.

In all cases, the doses and risks are shown to be low. Using actual post-remedial measured data, the doses and risks are trivially insignificant.

3.2.5 Metal Recycling

In July 2000, Secretary Richardson imposed a suspension on recycling of metal within the DOE complex. This was principally in response to concerns over recycling of nickel from gaseous diffusion plants, however the suspension applied to all metals (does not apply to metals still left in buildings after they have been released). In a memorandum, Secretary Richardson noted that,

> "Our existing release criteria, described in DOE Order 5400.5, limit the potential for radiation exposure to the public to levels well below applicable requirements. Our experience with existing criteria also shows that most scrap metal released is either not contaminated at all or has residual levels of surface contamination well below the current DOE standard."

The EPA, on their web-site http://www.epa.gov/radiation/cleanmetals/ state,

> "Much of the metal at DOE and NRC licensed sites is not contaminated, and can be released for unrestricted use. DOE and NRC also maintain criteria for determining contamination levels for any material released, and therefore the likelihood of dangerously contaminated material being released is very small. In addition we found that the amount of scrap metal being generated from these facilities was only about 0.1% of the amount of metal used annually in the U.S."

The recently issued ANSI standard, ANSI/HPS N13.12-1999, "Surface and Volume Radioactivity Standards for Clearance," concluded that existing Regulatory Guide 1.86 surface contamination limits result in less than 1 mrem/yr exposure.

Table 3-3. Occupancy Dose and Risk for Building 4012

Occupancy Risk Analysis for B/4012				
	Room 110		Room 109	
	Dose (mrem/yr)	Risk	Dose (mrem/yr)	Risk
Measured Average Surface Contamination	0.003	6×10^{-8}	0.01	2×10^{-7}
Measured Maximum Hotspot (assume all surfaces are at maximum measured value)	0.03	6×10^{-7}	0.09	2×10^{-6}
Reg. Guide 1.86 Release Limits (assume all surfaces are at RG 1.86 limits)	0.4	8×10^{-6}	0.4	8×10^{-6}
Natural Background Radiation Exposure at Home	300	6×10^{-3}	--	--
Assumptions:	(1) RESRAD-Build Version 2.37 (2) Worker is in B/4012, 40 hours per week, 52 weeks per year for 50 years. (3) Alpha measurements are due to 93% enriched uranium. (4) Beta measurements are 50%/50% mixed Cs-137 and Sr-90.			

Table 3-4. Dose and Risk for Building 4028 Debris

Scenario Description	Target	Exposure Time (years)	Dose		Risk[c]	
			U Nat[a]	Units	U Nat[a]	Units
Transportation	Individual driver (max)[b]	1	1.8E-04	mrem	7.2E-11	Individual risk
Transportation	Collective public	1	1.3E-05	person-mrem	5.2E-12	Collective risk
Disposal site	Collective public	30	5.5E-05	person-mrem/yr	6.6E-10	Collective risk
Disposal site	Individual public (max)	30	1.3E-05	mrem/yr	1.6E-10	individual risk
Disposal site	Individual worker (max)	20	4.6E-05	mrem/yr	3.7E-10	Individual risk
Approx. dose/risk from clean soil		30	28[d]	mrem/yr	3.4E-04	Individual risk
Approx. risk of driving in the US		30	-	-	9.0E-03	Individual risk

a. All concrete assumed to have 0.11 pCi/g U-234, 0.005 pCi/g U-235, and 0.11 pCi/g U-238, which are based on the maximum measured beta values from the 4028 final survey. All beta activity was assumed to be U-238, and U-234 and U-235 were calculated based on natural uranium activity ratios. All surfaces were assumed to be contaminated at the maximum level. 10,260 cu. yards of concrete. Concrete not packaged. Default values for input Data Table 2 parameters were used.

b. 1 truck with 2 drivers transports all the concrete.

c. Conversion from mrem to lifetime risk = 4E-07 risk per mrem

d. Average annual dose from naturally occurring radionuclides in soil. Source: Radiation: Risk and Realities. U.S. Environmental Protection Agency. EPA 402-K-92-004.

Analyses, performed by Rocketdyne using RESRAD-Recycle, have confirmed these positions. Table 3-5 shows results of dose and risk analysis of metal recycled from Building 4012 using conservative assumptions. In all cases, the doses and risks are shown to be low, using actual post-remedial measured data.

Table 3-5. Dose and Risk Analysis of Metal Recycled from Building 4012

Scenario Exposure Path	Target	Exposure Time (years)	Dose		Risk[b]	
			Cs/Sr/U[a]	Units	Cs/Sr/U[a]	Units
Room/office	Individual public (max)	30	3.1E-04	mrem/yr	3.7E-09	Individual risk
Appliance	Individual public (max)	10	8.2E-06	mrem/yr	3.3E-11	Individual risk
Automobile	Individual public (max)	10	2.5E-04	mrem/yr	9.9E-10	Individual risk
Office furniture	Individual public (max)	10	1.4E-04	mrem/yr	5.7E-10	Individual risk
Home furniture	Individual public (max)	10	2.7E-04	mrem/yr	1.1E-09	Individual risk
Frying pan	Individual public (max)	10	7.9E-06	mrem/yr	3.2E-11	Individual risk
Recycle worker	Individual worker (max)	1	6.8E-05	mrem/yr	2.7E-11	Individual risk
Approx. dose/risk from clean soil		30	28[c]	mrem/yr	3.4E-04	Individual risk
Approx. risk of driving in the US		30	-	-	9.0E-03	Individual risk

a. All steel assumed to have 6.6E-02 pCi/g Cs-137, 6.6E-02 pCi/g Sr-90, 6.2E-02 pCi/g U-234, 1.1E-03 pCi/g U-235, and 1.3E-05 pCi/g U-238, which are based on the maximum measured alpha and beta values from the Building 4012 final survey. Decay time since the survey was 4 years. All surfaces were assumed to be contaminated at the maximum level. 22 tons of steel. Increased ingot partition to 10%. All other parameters were default

b. Conversion from mrem to lifetime risk = 4E-07 risk per mrem

c. Average annual dose from naturally occurring radionuclides in soil. Source: Radiation: Risk and Realities. U.S. Environmental Protection Agency. EPA 402-K-92-004.

3.2.6 Donation of Trailers

Rocketdyne was directed by the US General Services Administration (GSA) to make donations of DOE-owned trailers located in Area IV of SSFL. These trailers were not used to store radioactive materials nor were they used for any operations involving radioactive materials. The buildings were never in a radiologically controlled area. They were in fact used as normal office space. There is no regulatory requirement to perform radiation surveys of non-radiological buildings.

In February 2000, questions were raised by Senator Boxer's office relating to the donation of trailers to the Shandon Unified School District and the L.A. Wildlife Waystation. In response, the DOE committed to perform a radiological survey of the trailers. Personnel from Rocketdyne's Radiation Safety Department performed surveys of these trailers on February 7, 10, and 11. Reports documenting these surveys were prepared and transmitted to DOE/OAK who in turn forwarded them to the various parties involved. The surveys demonstrated that no elevated radiation above normal background levels was detected.

Representatives from the California State Department of Health Services (DHS) Radiological Health Branch (RHB) and the Los Angeles County Department of Health Services (Radiation Management) were also present to perform independent surveys. A letter was issued by the DHS on February 14, 2000 stating that "the surveys did not reveal any radioactive contamination or radiation levels that are different from the background radiation level." [DHS 2000].

At DOE-EM's request, soil samples were also taken at the school site and at background locations in Shandon [GRC 2000]. No evidence of contamination was found.

3.2.7 Former Sodium Disposal Facility (FSDF) Soil

In May 1998, following numerous radiological soil sample surveys by Rocketdyne and DHS, the DHS released the FSDF for (radiologically) unrestricted use [DHS 1998]. In May 2000, the DTSC and DHS gave approval for approximately 13,000 cubic yards of FSDF soil with trace levels of PCBs, dioxins, and mercury to be shipped to a Class I hazardous waste facility. Concerns were expressed that this soil was radioactive waste and should be sent to a licensed low-level radioactive waste facility. DTSC and DHS reviewed the record, and in December 2000 reaffirmed their decision staying that,

> "The soil from the Former Sodium Disposal Facility currently stored on site was released by DHS with no radiological restrictions. DHS has carefully reconsidered the issues presented and has concluded, with confidence, that the soils at issue do not present a radiological health hazard. DHS and DTSC concur that the soils at issue may legally and safely be disposed of at a permitted Class I hazardous waste facility."

Rocketdyne performed conservative analyses using the IMPACTS code to calculate the dose and risk of the FSDF soil at the Class I hazardous waste site. It was conservatively assumed that all soil was contaminated at the maximum measured Cs-137 and Sr-90 levels of 0.6 pCi/g and 0.6 pCi/g, respectively. In reality, all soil samples, except four, were less than background

for these radioisotopes. No subtraction of background was performed for the dose/risk analysis. The calculated maximum public individual dose is 3.7×10^{-6} mrem/year, which is trivially insignificant even with the conservative assumption.

3.2.8 Brush Fires

Following the occurrence in 2000 of brush fires at DOE facilities at Los Alamos, Hanford, and INEEL, concerns were raised about the potential for vegetation burning on contaminated land to result in airborne contamination that could be a hazard to firefighters and the community.

The following is a response to those concerns.

Vegetation Sampling. Rocketdyne and its predecessor, Atomics International sampled vegetation both on-site and in the local community during its nuclear research activities from 1956 to 1989. During 1989 to the present, Rocketdyne and agencies have sampled vegetation both on-site and on neighboring land. No evidence of any radioactive contamination in vegetation has ever been found.

Vegetation sampling at 28 SSFL locations in November 2000, including the Sodium Reactor Experiment (SRE), the Hot Lab, the Nuclear Material Development Facility, Building 4064, and the Former Sodium Disposal Facility (FSDF), found no evidence of radioactive contamination in vegetation (see section 5.2.5).

Rocketdyne welcomes independent vegetation sampling by an appropriate agency to verify this conclusion.

Fire Protection. Rocketdyne maintains its own Fire Department at SSFL staffed by contract employees. Rocketdyne maintains formal cooperative agreements with the Ventura County Fire Department, the LA County Fire Department and the LA City Fire Department. Rocketdyne participates in training exercises with these local fire departments.

Rocketdyne maintains a heli-pad and water supplies at SSFL that are used by local fire departments to refill their water-dropping helicopters during any brush fire-fighting operations within the vicinity of SSFL. SSFL and its neighbors are therefore better protected than many rural mountainous communities.

Rocketdyne's only active radiological facility is the Radioactive Material Handling Facility (RMHF) that is used the store and package radioactive waste for subsequent transportation to disposal sites. Industrial-size sprinkler systems are located around the northern and western sides of the facility with the sole purpose to operate during brush fires. The other two sides of the facility are bounded by rock and asphalt paved roadways.

Brush abatement is performed annually around facilities and roadways.

Air Monitoring. Continuous air samplers at Area IV of SSFL monitor airborne activity. These stationary air-sampling stations would monitor any potential airborne activity. In addition, existing portable air sampling stations could be quickly set up at additional downwind locations if the need arose.

3.2.9 Worker Health Study

One of Rocketdyne's commitments to its employees following the DOE-funded Worker Health Study was to perform a follow-on study. This study attempts to answer some questions raised by the initial study performed by UCLA.

Rocketdyne and the UAW, together selected a Science Committee, comprising six nationally renowned, experts in the fields of epidemiology, biostatistics, toxicology and public health. None of the Science Committee were on the Peer Review team that Rocketdyne had hired to review the UCLA study. During 2000, this Science Committee issued an RFP and received six bids from academic and professional institutions. The Science Committee selected a team headed by the International Epidemiology Institute. Other team members include the staff from the University of Southern California, Vanderbilt University, Oak Ridge National Laboratory (ORNL), Oak Ridge Associated Universities (ORAU), Lovelace Respiratory Research Institute and IHI Environmental.

The study, initiated in January 2001, will attempt to answer the basic question of whether Rocketdyne and Atomics International workers have suffered health effects as a result of occupational exposures to radiation and other toxic chemicals. The project will take 3 to 4 years to complete and is being funded entirely by Rocketdyne.

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4. ENVIRONMENTAL PROGRAM INFORMATION

At SSFL, the "DOE Site Closure" department has programmatic responsibility for the former radiological facilities, former sodium test facilities, and related cleanup operations. "DOE Site Closure" is responsible for environmental restoration and waste management operations in Area IV, where DOE-funded programs conducted energy-related research and development (R&D). Environmental restoration activities include decontamination and decommissioning (D&D) of radioactively contaminated facilities, building demolition, treatment of sodium, assessment and remediation of soil and groundwater, surveillance and maintenance of work areas, and environmental monitoring. Waste management activities include waste characterization and certification, storage, treatment, and off-site disposal. Waste management activities are performed at the Radioactive Materials Handling Facility (RMHF) for radioactive and mixed waste. The Hazardous Waste Management Facility (HWMF) has been used to handle alkali metal waste, but is currently inactive and undergoing closure.

4.1 ROCKETDYNE ENVIRONMENTAL PROTECTION AND REMEDIATION

Oversight of the environmental protection at Rocketdyne is the responsibility of the Safety, Health & Environmental Affairs (SHEA) department, and this department provides support for environmental management and restoration. The stated policy of SHEA is "To support the company's commitment to the well-being of its employees, community, and environment. It is Rocketdyne's policy to maintain facilities and conduct operations in accordance with all federal, state, and local requirements and contractual agreements. Rocketdyne employees are responsible for implementing and complying with this policy." Responsibilities for environmental protection at Rocketdyne fall under four subdepartments: Environmental Protection (EP), Environmental Remediation (ER), Radiation Safety (RS), and DOE Site Restoration. The responsibilities for each are listed below.

Environmental Protection (EP) is responsible for developing and implementing cost-effective and efficient programs designed to ensure achievement of the policy objectives related to environmental protection. The EP responsibilities include:

- Ensuring compliance with applicable federal, state, and local rules and regulations, including maintaining a working knowledge of applicable environmental laws, performing compliance audits, reviewing new and modified facility projects, coordinating solid and hazardous waste disposal, maintaining required records, preparing and submitting required regulatory reports, applying for and maintaining permits and assuring compliance with permit conditions, and performing sampling and analysis.

- Responding to uncontrolled releases, and reporting releases as required by law and contractual requirements.

- Suspending operations determined to be in violation of environmental regulations.

- Participating in rule and regulatory development, including evaluating impacts on Rocketdyne programs, coordinating with other Rocketdyne functions, as appropriate, and informing management and staff of new or revised requirements.

- Providing a program, in conjunction with Technical Skills and Development, for motivating, informing, and training employees about their duties to comply with environmental regulations and protect the environment.

- Recognizing and responding to the community's concerns regarding the environmental impact of Rocketdyne operations including escorting and cooperating with regulatory officials interested in environmental matters and responding to requests for information referred to Communications.

- Working with Rocketdyne customers and suppliers to minimize the use of materials and processes impacting the environment while maintaining product quality and competitive pricing.

- Making environmental concerns, energy and raw material conservation a priority when evaluating new and existing operations and products or when making decisions regarding land use, process changes, materials purchases, and business acquisitions.

Radiation Safety (RS) is responsible for providing radiological support for the D&D of radiological contamination at all Rocketdyne facilities. The RS responsibilities include:

- Compliance with all federal, state, and local regulations pertaining to occupational and environmental radiation protection.

- Provision of health physics oversight of D&D and radioactive waste management activities.

- Performance of final surveys of D&D'd buildings and facilities to demonstrate acceptability for release for unrestricted use.

- Response to employee and public concerns regarding radiological activities and the impact of these activities on the health and safety of the community.

Environmental Remediation (ER) is responsible for remedial actions to clean up historical chemical contamination at all Rocketdyne facilities. The ER responsibilities include:

- Compliance with all federal, state, and local regulations pertaining to environmental remediation.

- Remediation of historical chemically contaminated Rocketdyne sites to achieve closure.

- Implementation of groundwater monitoring and treatment.

- Implementation of RCRA soil sampling and cleanup activities.

DOE Site Restoration is responsible for performing the "hands-on" D&D of former DOE nuclear and liquid metal test facilities in support of the DOE Closure program. DOE Site Restoration responsibilities also include:

- Responsibility for the management and shipment of radioactive waste, generated during the D&D operations, to DOE-approved disposal sites.
- Operation of the Radioactive Materials Handling Facility (RMHF) under an interim status Part A permitted facility for the management of mixed (radioactive and hazardous) wastes.
- Coordination of activities with specialty contractors used to support D&D activities including asbestos and lead abatement, recycling of sodium from former liquid metal facilities, and demolition of structures following removal of hazardous materials and components.
- Performance of the routine Surveillance and Maintenance (S&M) activities for DOE-owned facilities to ensure that the buildings are properly maintained such that the buildings do not create personnel or environmental safety hazards.
- Responsibility for identifying, removing, staging, and initiating documentation for DOE equipment being divested.

4.2 ENVIRONMENTAL MONITORING PROGRAM

The purpose of the environmental monitoring program is to detect and measure the presence of hazardous and radioactive materials and identify other undesirable impacts on the environment. It includes remediation efforts to correct or improve contaminated conditions at the site and prevent off-site effects. For this purpose, the environment is sampled and monitored, and effluents are analyzed. A goal of this program is to demonstrate compliance with applicable regulations and protection of human health and the environment. Environmental restoration activities at the SSFL include a thorough review of past programs and historical practices to identify, characterize, and correct all areas of potential concern. The key requirements governing the monitoring program are DOE Orders 5400.1 [DOE 1990] and 5400.5 [DOE 1993]. Additional guidance is drawn from California regulations and licenses, and appropriate standards.

The basic policy for control of radiological and chemical materials requires that adequate containment of such materials be provided through engineering controls, that facility effluent releases be controlled to federal and state standards, and that external radiation levels be reduced to ALARA through rigid operational controls. The environmental monitoring program provides a measure of the effectiveness of these operational procedures and of the engineering safeguards incorporated into facility designs.

4.2.1 Radiological Monitoring

Monitoring the environment for potential impact from our past nuclear operations has been a primary focus of Rocketdyne and its predecessors.

In the mid-1950s, Atomics International, then a Division of North American Aviation, began initial plans for nuclear research at its facilities in the west San Fernando Valley. In 1956, before initial operations, it began an ambitious monitoring program to sample, and monitor, environmental levels of radioactivity in and around its facilities.

During the 45-year history of nuclear research and later environmental restoration, on-site and off-site environmental monitoring and media sampling has been extensive. In the early years, soil/vegetation sampling was conducted, on a monthly basis, as far west as the Moorpark freeway, as far north as the Ronald Reagan freeway, as far east as Reseda, and as far south as the Ventura freeway. Soil/vegetation and water samples were also taken around the Canoga and De Soto facilities, and around the Chatsworth Reservoir. This extensive off-site sampling program was terminated in 1989 when all nuclear research and operations (except remediation) came to an end.

During the 1990s, extensive media sampling programs have been conducted on our northern neighbors (including the Brandies-Bardin Institute and the Santa Monica Mountains Conservancy), our neighbors to the south, the Rocketdyne Recreation Center in West Hills, various private homes in the Chatsworth and West Hills areas, and places as far afield as Wildwood Park and Tapia Park. These sampling projects have been in addition to the routine monitoring of off-site radiation using TLDs, routine groundwater monitoring of off-site wells and routine sampling of surface water runoff from the site.

Figure 4-1 shows sampling and monitoring locations for these two time periods.

Rocketdyne has not been alone in off-site sampling. Independent sampling has been performed by no less than 12 organizations. These are:

- ANL - Argonne National Laboratory
- DHS/EMB - California Department of Health Services--Environmental Management Branch
- EPA/ORIA - US Environmental Protection Agency - Office of Radiation and Indoor Air
- DHS/RHB - California Department of Health Services - Radiologic Health Branch
- GRC - Groundwater Resources Corporation
- Joel Cehn (consultant to the Brandies-Bardin Institute), Lawrence Livermore National Laboratory (LLNL)
- McLaren/Hart Environmental Engineering Corp.

- ORAU - Oak Ridge Associated Universities
- ORISE - Oak Ridge Institute of Science and Education
- Ogden Environmental and Energy Services
- RWQCB - Regional Water Quality Control Board

Table 4-1 shows a matrix of sampled media, sampling organization, and sampling time period for all historical off-site radiological monitoring.

The evidence from thousands of soil, vegetation, water, and air samples taken from over 200 off-site locations over the last 45 years by Rocketdyne and 12 other agencies and organizations demonstrates that no radioactive contamination has been detected off-site that could result in any exposure or any risk to our neighbors.

- The EPA has stated that, "EPA is not aware of any current contamination from the SSFL that poses an unacceptable risk to the community."
- The ATSDR has stated that, “There is currently no indication that off-site residential areas have been adversely impacted by materials from the site.”

Our ongoing radiological environmental monitoring ensures that activities at the Santa Susana Field Laboratory, including cleanup, do not adversely affect either our employees or our neighbors.

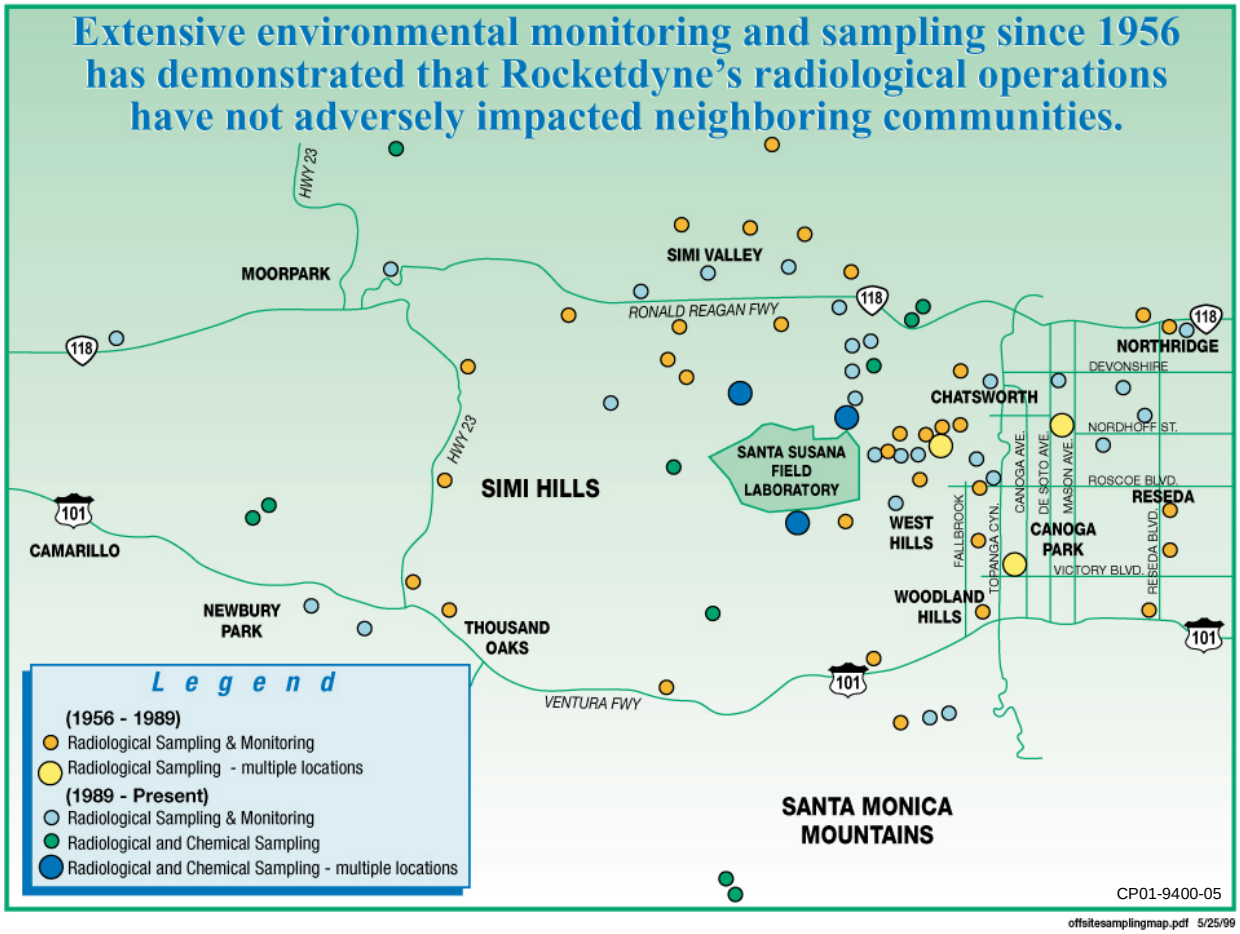

Figure 4-1. Radiological Sampling and Monitoring Locations

Table 4-1. Organizations Conducting Radiological Environmental Sampling

Environmental Sampling for Radiation/Radioactivity Surrounding Santa Susana					
Location	**Media Sampled (Date Range and Organization)**				
	Soil	**Groundwater**	**Surface Water**	**Airborne Particulates**	**Radiation Exposure**
On-Site	1956-Present (Rocketdyne) 1975, 81, 84 (ANL) 1986-87 (ORAU) 1992-Present (ORISE) 1993 (RWQCB) 1992-Present (DHS/RHB) 1994-95 (DHS/EMB)	1960-86 (Rocketdyne) 1984-Present (GRC) 1998 (EPA/ORIA)	1970-Present (Rocketdyne) 1993-98 (RWQCB)	1956-Present (Rocketdyne)	1971-Present (Rocketdyne) 1975, 81, 84 (ANL) 1981-Present (DHS/RHB) 1986-87 (ORAU) 1992-Present (ORISE)
North Off-Site	1956-89 (Rocketdyne) 1992-94 (McLaren/Hart) 1992-94 (EPA/ORIA) 1992-94 (DHS/EMB) 1991-97 (Cehn) 1995 (Rocketdyne) 1995 (ORISE)	1984-Present (GRC) 1991-96 (Cehn) 1998 (EPA/ORIA)	1992-94 (McLaren/Hart) 1992-94 (EPA/ORIA) 1992-94 (DHS/EMB) 1992-94 (Cehn)	1989 (DHS/RHB and LLNL)	1974-Present (Rocketdyne) 1992-94 (EPA/ORIA) 1995 (ORISE)
East Off-Site	1956-89 (Rocketdyne) 1986 (ORAU) 1994 (Rocketdyne) 1995 (ORISE) 1997 (LLNL)	1984-Present (GRC)	1961-71 (Rocketdyne)	1959-Present (Rocketdyne)	1974-Present (Rocketdyne) 1986 (ORAU) 1995 (ORISE)
South Off-Site	1956-89 (Rocketdyne) 1992-94 (McLaren/Hart) 1992-94 (EPA/ORIA) 1992-94 (DHS/EMB) 1992-94 (Cehn) 1995 (Rocketdyne) 1998 (Ogden)	1984-Present (GRC)	1966-89 (Rocketdyne)	1989 (DHS/RHB and LLNL)	1974-Present (Rocketdyne)
West Off-Site	1956-64 (Rocketdyne) 1992-94 (McLaren/Hart) 1992-94 (EPA/ORIA) 1992-94 (DHS/EMB) 1992-94 (Cehn) 1995 (Rocketdyne)	1984-Present (GRC)	None	None	1974-Present (Rocketdyne)

4.2.2 Non-Radiological Monitoring

Extensive monitoring programs for chemical contaminants in air, soil, surface water, and groundwater are in effect to assure that the existing environmental conditions do not pose a threat to the public welfare or environment. Soils contaminated by petroleum products are remediated whenever underground fuel tanks are removed. Extensive soil sampling is performed under the Resource Conservation and Recovery Act Facility Investigation and other site-specific remedial programs. Groundwater beneath Area IV is extensively monitored for chemical contaminants through sampling at 47 on-site and off-site wells. Groundwater analyses were conducted by Haley & Aldrich (formerly Groundwater Resources Consultants, Inc.) following a DTSC-approved sampling and analysis plan and approved EPA analytical methods. Equipment installed in an interim groundwater remediation program in Area IV continuously removed solvents from contaminated groundwater during 2000. This system returned remediated water to the surface water collection ponds.

All surface water discharges are monitored as specified in the existing National Pollutant Discharge Elimination System (NPDES) permit. The NPDES permit was renewed in 1998. In addition, all sources of emissions are monitored as required by the Ventura County Air Pollution Control District (VCAPCD).

In addition to this environmental monitoring and restoration program, current operational procedures reflect Rocketdyne's commitment to a clean and safe environment. For example, solvents and oils are collected and recycled, rather than being discarded. A comprehensive training and employee awareness program is in place. All employees working with hazardous materials are required to attend a course on hazardous materials waste management. Environmental bulletins are printed on the internal Rocketdyne web site to promote environmental awareness among all employees.

4.3 INTEGRATED SAFETY MANAGEMENT SYSTEMS (ISMS)

The ETEC Integrated Safety Management System (ISMS) Description is a recap of the Boeing Canoga Park policies and procedures in DOE principle and objective format detailing the formal, organized processes whereby personnel plan and conduct work in a safe manner, then assess and improve the processes as necessary. The major concepts of ISMS are integrating safety awareness and best management practices. In 2000, a new ISMS training class specific to the ETEC Closure Contract was initiated and taught. This class was based on the ISMS Description that was created and provided to the DOE relative to the closure activities. The description document and the training class encompassed all levels of activities and documentation related to safety management to ensure protection of workers, the public, and the environment.

4.4 ENVIRONMENTAL TRAINING

Rocketdyne conducts training and development programs as an investment in human resources to meet both organizational and individual goals. These programs are aimed toward improving employee performance, assuring employee proficiency, preventing obsolescence in employee capability, and preparing employees for changing technology requirements and for possible advancement.

The People Organization is responsible for the development and administration of formal training and development programs. Process managers are responsible for individual employee development through formal training, work assignments, coaching, counseling, and performance evaluation. Process managers and employees are jointly responsible for defining and implementing individual training development goals and plans, including on-the-job training.

The Rocketdyne Training and Development Department currently maintains a listing of approximately 700 courses available for Rocketdyne personnel. Of these, approximately 102 relate to environment, health, and safety, with approximately 10 relating to environmental protection, 10 to radiation safety and remediation, and 82 to health and safety. Specialized training programs on new technological developments and changes in regulations are provided, as needed, to assure effective environmental protection and worker health and safety. Also, informal discussions about waste minimization and management occur at hazardous waste coordinator's meetings. Several courses are available as computer-based training. Additional off-site courses are also encouraged.

4.5 WASTE MINIMIZATION AND POLLUTION PREVENTION

4.5.1 Program Planning and Development

A Waste Minimization and Pollution Prevention Awareness Plan developed in accordance with DOE Order 5400.1 [DOE 1990] has been in place since December 1993. This plan [Atkinson 1996] serves as a guidance document for all waste generators at the ETEC. The plan emphasizes management’s proactive policy of waste minimization and pollution prevention, and outlines goals, processes, and waste minimization techniques to be considered for all waste streams generated at the former ETEC. The plan requires that waste minimization opportunities for all major restoration projects be identified and all cost-effective waste reduction options be implemented.

The majority of waste currently generated at the former ETEC results from environmental restoration of surplus facilities and clean up of contaminated sites from previous programs. The key hazardous components of waste generated at ETEC are:

- Low-level radioactive waste (LLW), mixed, hazardous, and non-hazardous wastes from D&D operations.
- Sodium and NaK-contaminated components from D&D operations at the former sodium facilities.
- Oils from ongoing remediation activities.

In general, the measures used to promote waste minimization at ETEC are:

- Using comprehensive segregation and screening procedures to minimize mixed wastes by separating LLW and hazardous wastes.
- Using survey and decontamination processes to release concrete and steel for potential recycling/reuse.

- Removing bulk sodium from facility drain tanks for recycling/reuse.
- Converting residual sodium in piping and components to high-grade sodium hydroxide for commercial use.
- Reusing containers of radioactive LLW for storage.
- Linking of a chemical/material exchange system with the purchasing system to reduce purchases of hazardous materials.
- Reducing non-hazardous waste disposal through process changes and recycling.
- Using/operating improved air filtration technology in decontamination facility to minimize generation of filter media wastes.

Waste minimization is accomplished by evaluating the waste generating processes, identifying waste minimization options, and finally conducting technical and economic evaluations to determine the best approach.

4.5.2 Training and Awareness Programs

The ETEC Waste Minimization and Pollution Prevention Awareness Program includes (1) orientation programs and refreshers, (2) specialized training, and (3) incentive awards and recognition. Employees are reminded about pollution prevention and waste minimization awareness. Posters are placed in work areas to notify employees about environmental issues or practices. Memoranda are circulated about changes in waste management policy, Rocketdyne policies or procedures, and technical data relevant to an employee's job assignment. Presentations using visual aids are provided, as needed, to review major changes in environmental issues.

4.5.3 Waste Minimization and Pollution Prevention Activities

The following are some significant activities related to waste minimization and pollution prevention.

- Oils used in motor vehicles and compressors are shipped to vendors who recycle them.
- Use comprehensive segregation and screening procedure of RA materials resulting in the salvage of usable non-radioactive scrap metal.
- A chemical/material exchange system is currently linked to the purchasing system and prevents the unnecessary purchase of hazardous materials.
- Hazardous waste containers in acceptable condition are reused to the maximum extent possible.
- Empty product drums returned to the vendor for reuse when practical.
- Approximately 80% of the office paper and aluminum cans are recycled as a result of increased environmental awareness. During CY00, 3.9 metric tons of white paper and 2.2 metric tons of aluminum cans were recycled.

- Use of a compactor to reduce the volume of soft low-level radioactive waste from approximately 1,000 cubic feet to 200 cubic feet during CY00.

- Size reduction and repackaging of a portable HEPA unit and ladders achieved a waste reduction of approximately 160 cubic feet during CY00.

- Operation of a Torit self-cleaning filter unit in a radiological decontamination facility eliminated waste consisting of about 12 used prefilters that would have been generated using a conventional unit in CY00.

- Approximately 8,400 pounds of residual sodium in tanks and piping systems was converted into commercial-grade sodium hydroxide using a WVN process. This resulted in avoiding generating approximately 1,850 gallons of hazardous waste during 2000.

- Approximately 94 metric tons of clean recyclable stainless steel and 700 metric tons of carbon steel resulted from divestment activities at non-radiological facilities.

4.5.4 Tracking and Reporting System

Various categories of materials from procurement to waste disposal are tracked. Radioactive and mixed wastes are characterized sufficiently (for safe storage) by the generator, transferred to the RMHF, and logged and temporarily stored at the RMHF. Documents that accompany the wastes are verified for accuracy and completeness, and filed at the RMHF. Hazardous waste tracking and verification procedures (from generator to final off-site disposal) are followed by the SHEA department. Rocketdyne is responsible for all non-hazardous and sanitary waste operations at the SSFL.

Relevant reports include:

- EPA's Biennial Hazardous Waste Report

- DOE's Annual Waste Generation and Pollution Prevention Progress Report

- DOE's Affirmative Procurement Report

- "Source Reduction Evaluation Review and Plan" and "Hazardous Waste Management Performance Report," both of which are required by the "Source Reduction and Hazardous Waste Management Review Act (SB14)"

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5. ENVIRONMENTAL RADIOLOGICAL MONITORING

Environmental radiological monitoring program at SSFL began before the first radiological facilities were established in 1956. The program has continued with modifications to suit the changing operations. The selection of monitoring locations was based on several site-specific criteria such as topography, meteorology, hydrology, and the locations of the nuclear facilities. The prevailing wind direction for the SSFL site is generally from the north and northwest, with some seasonal diurnal shifting to the southeast quadrant. Most rainfall runoff at the SSFL site flows through several natural watercourses and drainage channels and is collected in two large-capacity retention ponds. This water may be discharged off-site into Bell Creek to the south, or it may be reused for industrial purposes. Surface water from Area IV also flows to the northwest and is monitored through five NPDES sampling locations.

Gross alpha and gross beta measurements of ventilation exhaust and ambient air samples are used for screening purposes. These screening measurements can quickly identify any unusual release and provide long-term historical records of radioactivity in the environment. At the end of each year, the air samples for the entire year are combined and analyzed for specific radionuclides. The isotopic analysis results are used for estimating the potential off-site dose from air pathway.

Gross alpha and gross beta analyses performed on surface water and groundwater permit direct comparison with the screening limits established by the EPA for suppliers of drinking water. For groundwater, samples are also analyzed for gamma emitters and tritium. Isotopic uranium and thorium analyses are performed if the gross alpha activity exceeds the drinking water limit. For surface water, Sr-90 and tritium analyses are also performed.

Direct radiation is monitored by the thermoluminescent dosimeters (TLDs) mounted on site boundary and throughout the site. To accurately measure low-level ambient radiation, “sapphire” TLDs, which are very sensitive to low-level radiation, are used. These TLDs are complemented by TLDs installed by the State of California DHS/RHB for independent surveillance.

5.1 EFFLUENT MORNITORING

The RMHF, Buildings 4024 and 4059 have continuous effluent monitoring capability. In 2000, effluent was only monitored for the RMHF because no radiological work was conducted in Building 4024 or 4059 requiring the use of a filtered exhaust system. The potential release of effluent radioactivity to uncontrolled areas is through filtered discharge of ventilation exhaust from the RMHF. Table 5-1 shows the airborne releases from the RMHF. No contaminated liquids are discharged to uncontrolled areas.

Continuous workplace ventilation is provided in the decontamination and packaging rooms at the RMHF, where equipment is decontaminated and radioactive waste is repackaged. This assures protection of the workers from inhalation of airborne radioactive materials and prevents the spread of radioactive contamination into adjacent clean areas. The ventilation exhaust is passed through the HEPA filters before being discharged to the atmosphere to prevent the release

Table 5-1. Atmospheric Effluents to Uncontrolled Areas

SSFL/RMHF - 2000	
Effluent volume (m^3)	3.20E+08
Air volume sampled (m^3)	2.63E+04
Annual average concentration in effluent	
Gross alpha (µCi/cc)	1.21E-15
Gross beta (µCi/cc)	1.09E-15
Maximum observed concentration	
Gross alpha (µCi/cc)	1.52E-14
Gross beta (µCi/cc)	1.01E-14
Activity releases (µCi)	
Gross alpha	3.87E-01
Gross beta	3.49E-01

Radionuclide-Specific Data

Radionuclide	Half-Life (yr)	Activity Detected (pCi)	Annual Release (µCi)	Analysis MDA* (pCi)	Release MDA (µCi)	Average Exhaust Concentration (µCi/cc)	DCG* (µCi/cc)
H-3*	1.23E+01	NA*	2.72E+01	NA	NA	8.49E-14	1E-07
Be-7	1.46E-01	ND*		83.90	1.02		natural*
K-40	1.26E+09	ND		42.80	0.52		natural
Co-60	5.26E+00	ND		3.19	0.04		8E-11
Sr-90	2.77E+01	ND		3.00	0.04		9E-12
Cs-137	3.00E+01	21.17	2.58E-01	2.79	0.03	8.06E-16	4E-10
Po-210	3.80E-01	3.56	4.33E-02	0.20	0.00	1.35E-16	natural
Th-228	1.91E+00	ND		0.50	0.01		4E-14
Th-230	8.00E+04	ND		0.50	0.01		4E-14
Th-232	1.41E+10	ND		0.50	0.01		7E-15
U-234	2.47E+05	0.90	1.10E-02	0.40	0.00	3.42E-17	9E-14
U-235	7.10E+05	ND		0.50	0.01		1E-13
U-238	4.51E+09	ND		0.70	0.01		1E-13
Pu-238	8.64E+01	ND		0.50	0.01		3E-14
Pu-239/240	24,390/6,580	ND		0.60	0.01		2E-14
Pu-241	1.52E+01	110.00	1.34E+00	90.00	1.10	4.19E-15	1E-12
Am-241	4.33E+02	ND		0.60	0.01		2E-14

* Naturally occurring radionuclides are included for information. These activities have not been used in dose estimates.

* H-3 concentration is directly measured from evaporated water sample.

* Derived Concentration Guide (DCG) for exposure of the public, for the most restrictive form of radionuclide as specified in DOE Order 5400.5 (2/8/90; Change 2: 1/7/93)

* MDA = Minimum Detectable Activity

* ND = Not Detected

* NA = Not Applicable

of airborne radioactivity. The filtered air generally contains lower levels of naturally occurring radionuclides than does ambient air.

The level of radioactivity contained in all atmospheric effluents is reduced to the lowest practical value by passing the effluents through certified HEPA filters. The effluents are sampled for particulate radioactive materials by means of continuously operating stack exhaust samplers at the point of release. In addition, the stack monitor installed at the RMHF provides automatic alarm capability in the event of the release of particulate activity. The HEPA filters used for filtering atmospheric effluents are at least 99.97% efficient for particles 0.3 µm in diameter.

The average concentration and total radioactivity, as gross alpha and gross beta activity, in atmospheric effluents to uncontrolled areas from the RMHF are shown in Table 5-1. The total shows that no significant quantities of radioactivity were released in 2000. The gross alpha and gross beta counts were done shortly after the weekly stack samples were collected, which permitted identification of any unusual release.

Tab;e 5-1 also presents the isotopic composition of the radioactivity deposited on the RMHF exhaust air sampling filters, combined for the entire year. Gamma-emitting radionuclides are measured by high-resolution gamma spectrometers; tritium is measured by electrolytic enrichment followed by liquid scintillation counting; and all others are measured by specific chemical separations followed by alpha or beta counting. For each radionuclide, the laboratory calculates the minimum detectable activity (MDA). This is the lowest activity that would be identified as “detected” with 95% confidence. For the purpose of comparing effluent releases, the laboratory MDA for the composited filters was converted to an equivalent annual release and is shown in the table as the release MDA. Radionuclides reported as less than the detection limits are shown as “not detected” (ND).

The Po-210 collected on the filters is a naturally occurring radionuclide from the U-238 decay chain in the environment. Small amounts of Cs-137, U-234, and Pu-241 on the filter samples are due to the materials involved in operations at the RMHF. Since the air sampling filter is not capable of catching H-3 in the air, H-3 concentration is directly sampled from the water evaporated through the RMHF ventilation stack.

The concentrations in the effluent at the exhaust stack are compared with appropriate reference values for non-occupational exposure. The isotopic reference values for DOE facilities are the DCGs (Derived Concentration Guide) specified in DOE Order 5400.5. These values refer to the permissible concentrations allowed by the State of California and the DOE for continuous, non-occupational exposure (i.e., to general public). The radionuclide concentrations released from the RMHF stack are far below the DCG, as shown in Table 5-2. Furthermore, dilution and dispersion occur before the material reaches an unrestricted area, which further reduce the concentration in the public area.

The U.S. EPA regulates airborne releases of radioactivity from DOE facilities under 40 CFR 61, Subpart H. The isotopic radionuclide concentrations in the exhaust ventilation are used to demonstrate compliance with State DHS/RHB, DOE, and EPA (NESHAPs) standards.

Table 5-2. Filtered Exhaust and Ambient Air Radioactivity Concentrations – 2000

Radionuclide	Activity Concentration (microcuries per cubic centimeter, µCi/cc)							
	Derived Conc. Guide	Exhaust	Ambient					
		RMHF Stack	RMHF	RMHF Pond	RIHL	T100	T886	Average
H-3	1E-07	**8.5E-14**						
Be-7	Natural							
K-40	Natural							
Co-60	8E-11							
Sr-90	9E-12							
Cs-137	4E-10	**8.1E-16**						
Po-210	natural	**1.4E-16**	**2.2E-15**	**6.1E-15**	**5.3E-15**	**4.9E-15**	**3.4E-15**	**4.4E-15**
Th-228	4E-14							
Th-230	4E-14						**1.9E-16**	**1.9E-16**
Th-232	7E-15							
U-234	9E-14	**3.4E-17**						
U-235	1E-13							
U-238	1E-13				**6.1E-16**			**6.1E-16**
Pu-238	3E-14							
Pu-239/240	2E-14		**8.0E-16**					**8.0E-16**
Pu-241	1E-12	**1.1E-14**						
Am-241	2E-14							
Gross Alpha	None	**1.2E-15**	**0.0E+00**	**0.0E+00**	**0.0E+00**	**0.0E+00**	**0.0E+00**	**0.0E+00**
Gross Beta	None	**1.1E-15**	**7.6E-15**	**9.8E-15**	**1.3E-14**	**1.8E-14**	**8.5E-15**	**1.1E-14**

The potential downwind radiation exposures due to the atmospheric emissions during 2000 from the RMHF exhaust stack are calculated using the CAP88-PC computer code. Site-specific input data such as wind speed, directional frequency and stability (developed by the NRC and ANL), and stack height and exhaust air velocity were used to perform the dose assessment.

The highest potential radiation exposure doses at the site boundary and the nearest residential area were estimated using the CAP88-PC computer code, and the results are presented in Table 5-3. Although the new SSFL site boundary is 300 meters from the RMHF, the maximum dose occurs at distance of 325 meters. Therefore, the boundary dose was calculated at this distance.

The airborne dose calculations were performed to demonstrate compliance with the NESHAPs standard. At the location of the hypothetical Maximally Exposed Individual (MEI), the effective dose equivalent from DOE facility exhaust during 2000 (RMHF) was 7.7×10^{-7} mrem (7.7×10^{-9} mSv) per year. The EPA limit for a DOE site is 10 mrem/yr, as specified in 40 CFR 61, Subpart H. Potential releases from the RMHF are so low that, even assuming absence of HEPA filters, estimated doses would be below the level requiring continuous monitoring. However, continuous monitoring is still being performed as a best management practice.

Table 5-3. Radiation Exposure Dose due to Atmospheric Effluents—2000

Facility	Distance (m) and Direction to		Downwind Exposure Dose (mrem/yr)	
	Boundary	Residence	Boundary	Residence
RMHF	325 NW	2,867 NW	7.9×10^{-6}	7.7×10^{-7}

In addition to the point source (i.e., the RMHF stack), two potential area sources are in Area IV: the RMHF Pond (Sump 614) and the RMHF North Slope. The RMHF Pond had been considered an area source due to the possible resuspension of contaminated sediment in the pond when it is dry. Since the RMHF Pond was covered by water for the entire year, it is not considered an area source for the year 2000. Similarly, the RMHF North Slope is now fully covered by native vegetation, and it is unlikely that wind borne resuspension of contaminated soil could occur.

5.2 ENVIRONMENTAL SAMPLING

5.2.1 Ambient Air

Ambient air sampling is performed continuously at SSFL with air samplers operating on 7-day sampling cycles. The sampling locations are shown in Figure 5-1 and listed in Table 5-4. Airborne particulate radioactivity is collected on glass fiber (Type A/E) filters that are changed weekly at the end of each sampling period. The samples are counted for gross alpha and beta radiation following a minimum 120-hour decay period to allow for decay of short-lived radon and thoron daughters. The volume of a typical weekly ambient air sample is approximately 50.4 m^3.

Weekly ambient air samples are counted for gross alpha and beta radiation with a low-background, thin-window, gas-flow proportional-counting system. The system is capable of simultaneously counting both alpha and beta radiation. The sample-detector configuration provides a nearly hemispherical (2π) geometry. The thin-window detector is continually purged with argon/methane counting gas. A preset time mode of operation is used for counting all samples.

Counting system efficiencies are determined routinely with Tc-99 and Th-230 standard sources. The activities of the standard sources are traceable to the National Institute of Standards and Technology (NIST).

Filter samples for each ambient air sampling location are composited annually and analyzed for isotopic-specific activity. The results of the sample analyses are shown in Table 5-2 with the RMHF stack effluent results for comparison. Like effluent air samples, the ambient air samples have radionuclide concentrations far below the DCG values. The variability in the measurements is dominated by weather effects and by analytical and background variations.

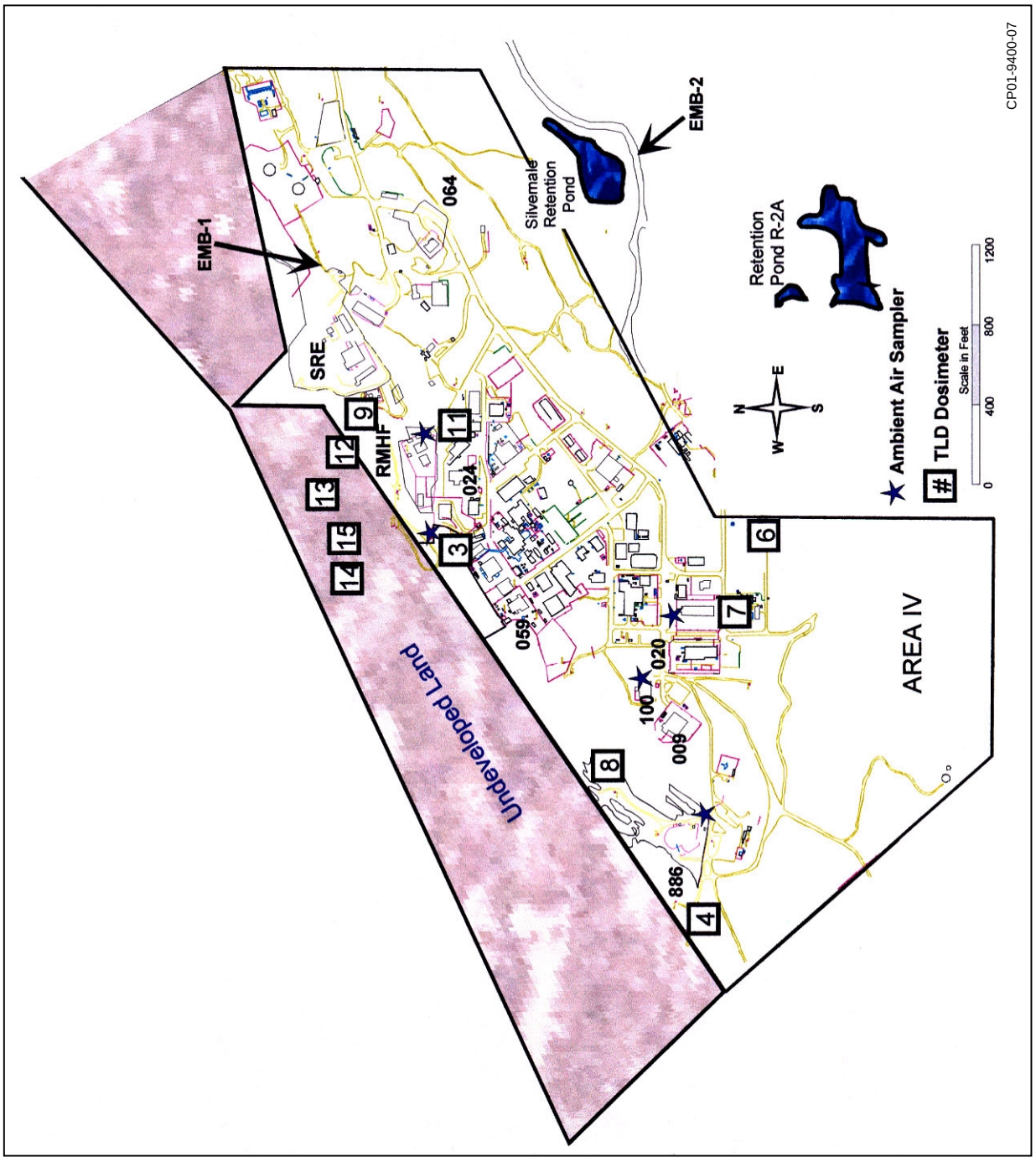

Figure 5-1. Map of Santa Susana Field Laboratory Area IV Sampling Stations

Table 5-4. Sampling Location Description

Station	Location	Sampling Frequency
Ambient Air Sampler Locations		
A-2	SSFL Site, 4020, northeast of site	(W)
A-3	SSFL Site, 4034, at main gate	(W)
A-4	SSFL Site, 4886, Former Sodium Disposal Facility	(W)
A-5	SSFL Site, RMHF Pond, north side	(W)
A-6	SSFL Site, 4100, east side	(W)
On-site - SSFL - Ambient Radiation Dosimeter Locations		
SS-3 (CA)	SSFL Site, Electric Substation 719 on boundary fence	(Q)
SS-4 (CA)	SSFL Site, west boundary on H Street	(Q)
SS-6 (CA)	SSFL Site, northeast corner of 4353	(Q)
SS-7 (CA)	SSFL Site, 4363, north side	(Q)
SS-8 (CA)	SSFL Site, Former Sodium Disposal Facility north boundary	(Q)
SS-9 (CA)	SSFL Site, RMHF northeast boundary at 4133	(Q)
SS-11 (CA)	SSFL Site, 4036, east side	(Q)
SS-12 (CA)	SSFL Site, RMHF northwest property line boundary	(Q)
SS-13 (CA)	SSFL Site, RMHF northwest property line boundary	(Q)
SS-14 (CA)	SSFL Site, RMHF northwest property line boundary	(Q)
SS-15 (CA) (or RMHF_Middle)	SSFL Site, RMHF northwest property line boundary	(Q)
EMB-1 (CA)	SSFL Site, SRE area north of 4003	(Q)
EMB-2 (CA)	SSFL Site, south of Silvernale retention pond, off Test Area Road	(Q)
Off-site Ambient Radiation Dosimeter Locations		
OS-1 (CA)	Off-site, Chatsworth	(Q)
BKG-11	Background Location, West Hills	(Q)
BKG-12	Background Location, Somis	(Q)
BKG-13	Background Location, Hollywood	(Q)
BKG-15	Background Location, Simi Valley (west)	(Q)
BKG-18	Background Location, Calabasas	(Q)
BKG-19	Background Location, Burbank	(Q)
BKG-22	Background Location, Saugus	(Q)

Codes		Locations	
A	Air Sampler Station	SS	SSFL
W	Weekly Sample	OS	Off-site
Q	Quarterly Sample	BKG	Background
CA	State Confirmatory Location	EMB	Environmental Management Branch

It should be emphasized that these measurements determine only the long-lived particulate radioactivity in the air and, therefore, do not show radon (Rn-222) and most of its progeny. Polonium-210 is a long-lived progeny and is detected by these analyses. It is assumed to be in equilibrium with its parent, Pb-210, whose relatively long half-life (22.3 years) provides an essentially constant level of Po-210 in the samples. Because of these effects, the ambient air, the air that is being breathed, is actually about four times as radioactive as implied in this table. Since most short-lived particulate radioactivity is removed from the exhaust air by the HEPA filters, these effects are not significant in the filtered effluent.

Because the gross alpha and gross beta activity are counted shortly after collection, most natural Be-7 is detected, which elevates the gross beta activity. Be-7 decays by electron-capture and emits a gamma ray in 10% of the decays; this gamma ray is detected as weak beta activity. The naturally occurring radionuclides, Po-210, Ra-226, and Ra-228, also contribute to the gross alpha and gross beta activities detected on the air filter samples. For year 2000, all gross alpha activities on the environmental air samples are reported as zero, because the detected gross alpha activities on field samples are less than the background.

Guide values for SSFL site ambient air are based on the effluent concentration values in DOE Order 5400.5 [DOE 1993]. The conservative guide value for alpha activity is 2×10^{-14} µCi/mL. The appropriate value for beta activity is 9×10^{-12} µCi/mL (Sr-90) due to the presence of Sr-90 in fission product contamination from previous work with irradiated nuclear fuel at the SSFL. Table 5-5 shows a complete list of the results from the gross alpha and gross beta counting of the ambient air samples.

The isotopic analysis of the environmental air samples indicates that the most significant radionuclide presented in the air is Po-210, which is a naturally occurring radionuclide from the U-238 decay series. Trace amounts of Th-230, U-238, and Pu-239/240 were detected in T886, T020, and RMHF, respectively. Since the quantities are so close to the detection limits, it is possible that these identifications are due to the fluctuation of measurement uncertainties. In any event, the reported concentrations are far below the DCGs, as shown in Table 5-2.

5.2.2 Groundwater

Forty-seven wells in and around Area IV are used to monitor the condition of the groundwater in the unconsolidated surface alluvium and the underlying Chatsworth formation. Figure 6-2 shows the locations of these wells. The purpose of these wells is to monitor concentrations of chemicals and/or radioactivity released by DOE operations. Water samples from these wells are periodically analyzed for radioactivity. In 2000, 43 water samples from 29 of these wells were collected and analyzed. Table 5-6 shows the summary results.

The drinking water standards have been assigned to groundwater by the State of California as a water-quality goal, and are applied here. Numerical limits for radionuclides not specifically listed by the State for drinking water were derived from the EPA generic dose limit of 4 mrem/year, as specified in 40 CFR 141. Except for three instances of gross alpha (16.1, 17.2, and 26.9 pCi/L), the monitored groundwater satisfies these goals. The high gross alpha concentrations are due to the presence of higher levels of naturally occurring uranium. Gamma spectrometry analysis did not detect any man-made beta and gamma emitters.

Table 5-5. Ambient Air Radioactivity Data—2000

Area	Activity	Number of Samples	Gross Radioactivity Concentrations (µCi/mL)		
			Annual Average Value and Dispersion	Maximum Value[a] and Date Observed	Average Percent of Guide[b]
SSFL Area IV	Alpha	51	0[c]	2.15E-15 (11/1)	0.0
T100	Beta		1.77E-14	4.91E-13 (3/8)	0.2
SSFL Area IV	Alpha	51	0	3.58E-15 (11/29)	0.0
Hot Lab	Beta		1.30E-14	1.06E-13 (12/6)	0.1
SSFL Area IV	Alpha	51	0	3.58E-15 (12/13)	0.0
RMHF	Beta		7.60E-15	7.72E-14 (12/13)	0.1
SSFL Area IV	Alpha	51	0	2.59E-15 (10/18)	0.0
4886	Beta		8.48E-15	6.68E-14 (12/6)	0.1
SSFL Area IV	Alpha	51	0	5.01E-15 (11/22)	0.0
RMHF Pond	Beta		9.83E-15	6.39E-14 (11/12)	0.1

[a]Maximum value observed for single sample.
[b]Guide SSFL site: 2E-14 µCi/mL alpha, 9E-12 µCi/mL beta, DOE Order 5400.5 (02/08/90).
[c]Values are background subtracted. zero indicates ≤ background values.

Table 5-6. Radioactivity in Groundwater at SSFL—2000

	Activity (pCi/L)									
	H-3	Cs-137	Th-228	Th-230	Th-232	U-234	U-235	U-238	Gross Alpha	Gross Beta
Water Suppliers MCL[a]	20,000	200	N/A			20 – Total Uranium			15	50
Maximum	2440	ND	0.09	1.28	0.07	15.10	0.80	13.20	21.00	28.70
Mean[b]	133	ND	0.01	0.79	0.04	7.80	0.42	7.16	5.88	7.22
Minimum	-139	ND	-0.10	0.42	0.01	1.55	0.08	1.53	0.38	0.57
Number of Analyses[c]	42 (34)	33 (33)	5 (5)	5 (1)	5 (5)	5 (0)	5 (1)	5 (0)	34 (8)	34 (6)

[a]From 40 CFR 141 and EPA limit of 4 mrem/yr (see text). N/A = not applicable
[b]The mean has been calculated from all reported values. ND = not detected
[c]Numbers in parentheses represent the number of analyses reported as less than the detectable limit.

Laboratory analyses were performed for tritium in 42 water samples from 29 groundwater-monitoring wells (Figure 6-2). Of the 42 analyses performed, eight samples from six wells (all on-site wells) had tritium concentrations higher than the detection limits. The positive tritium identifications had maximum concentrations of 317, 916, 2440, 200, 332, and 266 pCi/L at wells RD-24, RD-28, RD-34A, RD-34B, RD-54A, and RD-63, respectively. The maximum value among all the results, 2440 pCi/L in well RD-34A, is far below the EPA and California drinking water limit of 20,000 pCi/L.

Historically, well RD-34A, located on recently acquired land near the RMHF in Area IV, had higher concentrations of tritium than other wells in Area IV. Figure 5-2 shows the historical tritium analysis results for RD-34A. For comparison, the allowable limit in drinking water, 20,000 pCi/L, is used as the full scale on the plot. Since the first detection of about 7000 pCi/L in 1992, the tritium concentrations in this well have dropped down to the range of 1000 to 5000 pCi/L. In 2000, RD-34A had a tritium concentration of 2440 ± 150 pCi/L (8/29/00).

RD-24, near building 4059, showed 317 ± 130 pCi/L (2/3/00) and 267 ± 140 pCi/L (8/4/00). No off-site wells showed the presence of tritium. The occurrence of tritium in groundwater appears to have resulted from unintended production of tritium in soil surrounding various reactors, primarily in Buildings 4010 and 4059.

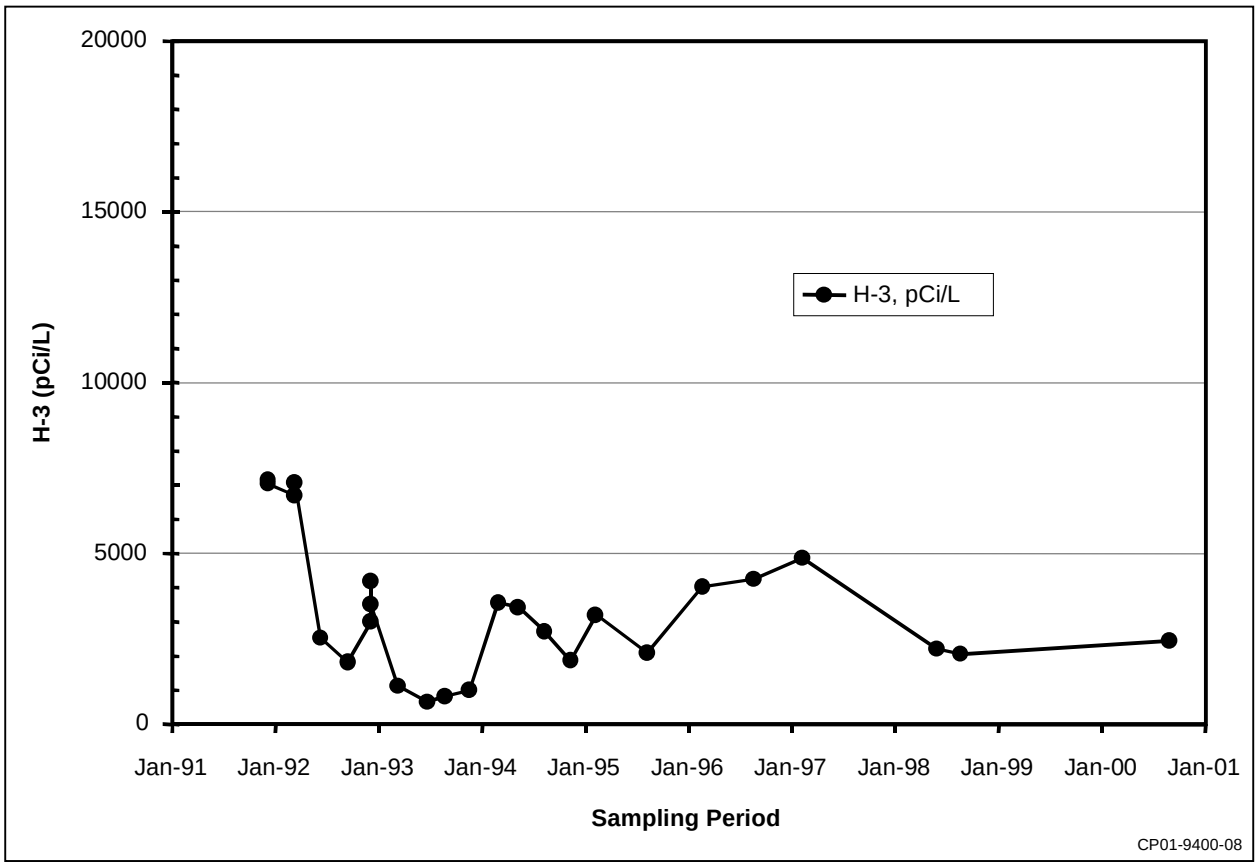

Figure 5-2. Tritium Concentration in Water from Well RD-34A

5.2.3 Surface Water and Domestic Water Supply

Most of Area IV slopes toward the southeast, and rainfall runoff is collected by a series of drainage channels and accumulates in the R2A Pond. Water from this pond is eventually released to Bell Creek under the NPDES permit. Some Area IV slopes to the northwest, and a small amount of rainfall drains toward the northwest ravines, which lead into Meier Canyon. To permit sampling of this runoff, five catch basins were installed in 1989 near the site boundary to accumulate runoff.

Table 5-7 summarizes the average radioactivity concentrations in these catch basin samples. For radioactivity, the maximum contaminant limits (MCL) applicable to suppliers of drinking water (Title 22, Chapter 15, Article 5, Section 64443, of the California Code of Regulations) are imposed on releases from the two southern controlled discharge points (Outfalls 001 and 002) and the five northwest slope runoff channels (Outfalls 003 through 007).

There was no indication of any radiological contamination of surface water discharges, and all results were below the drinking water supplier limits established in the NPDES permit.

Domestic water in this area is supplied by a variety of municipal and regional organizations, including the Los Angeles Department of Water and Power, the Los Angeles County Water District, several Ventura County Waterworks Districts, the Metropolitan Water District, the Burbank Public Service Department, and the Oxnard Public Works Department. Most of the water is imported from distant sources, such as Owens Valley, the Feather River, and the Colorado River. Some water, for Burbank, Oxnard, and Moorpark, comes from local groundwater wells. The local water is blended with imported water and treated to ensure purity and safety. Water is transported in open aqueducts and enclosed pipelines and is stored in open reservoirs and underground settling basins. The State of California requires that these suppliers routinely monitor their water for many potentially hazardous materials (and less significant aesthetic quality factors, as well) and report the results of this monitoring to their customers on an annual basis. Tests for radioactivity are relatively limited, and are performed over an extended period of time, so not all parameters are reported in any one year. The results reported by local water suppliers during 1999 are shown in Table 5-8 and represent the analysis results of water supplied from the Los Angeles Department of Water and Power, the Los Angeles County Water District, the Burbank Public Service Department, and Ventura County Waterworks District. Data for 2000 domestic water supplies was not available at the time of publication.

Comparison of the radioactivity concentrations in groundwater at SSFL from Table 5-7 with that of the local public supply water (Table 5-8) shows no significant differences in gross alpha or gross beta activities. H-3 and Sr-90 results were not reported by the local public water suppliers in 1999.

Table 5-7. NPDES Discharge Radioactivity Data for Northwest Slope Monitoring—2000

	Activity (pCi/L)			
	H-3	**Sr-90**	**Gross Alpha**	**Gross Beta**
Water Suppliers MCL	20,000	8	15	50
Maximum	160.00	1.37	8.00	13.00
Mean[a]	30.80	0.25	1.06	5.37
Minimum	-108.00	-0.06	-0.21	-0.95
Number of Analyses[b]	16 (16)	16 (14)	16 (14)	16 (5)

[a]Average of all reported values.
[b]Numbers in parentheses represent the number of analyses reported as less than the detectable limit.

Table 5-8. Domestic Water Supplies Radioactivity Data

		Gross Alpha	**Gross Beta**	**Ra-226 +Ra-228**	**Uranium**
MCL, pCi/L		15	50	5	20
Location		**Average (Range) Activity, pCi/L**			
Los Angeles Department of Water and Power	Los Angeles Aqueduct Filtration	3 (ND[a]-7)	3 (ND-5)	NA[b]	NA
	Encino Reservoir	4 (3-4)	5 (4-5)	NA	NA
	Metropolitan Water District Jensen Plant	2.4 (1.5-3.2)	ND (ND-4.4)	NA	NA
Los Angeles County Waterworks, District No.40	Surface Water	1.6 (1.0-2.3)	NA	NA	NA
	Groundwater	3.1 (3.0-3.3)	NA	NA	NA
City of Burbank		6.0 (2.7-6.5)	6.6 (0.3-11.3)	1.0 (ND-3.6)	5.7 (ND-9.5)
Ventura County Waterworks District No. 19	Metropolitan Water District Jensen Plant	3.1 (2.8-4.6)	4.4 (4.2-7.2)	1.5 (ND-3.6)	ND (ND-2.7)
	Lake Bard Water Filtration	3.1 (2.4-3.7)	5.5 (5.1-5.9)	ND (ND-0.5)	ND (ND-2.5)
	Wells	6.4 (0.3-17)	ND (ND)	NA	NA

a. ND = Not detected or above the detection limit set by DHS.
b. NA = Nor available.

5.2.4 Soil

The radioactivity in native rock and soil can serve as an indicator of any spread of contamination outside the operating facilities and other known areas of radioactive contamination. Soil radioactivity is due to various naturally occurring radionuclides present in the environment and due to radioactive fallout of dispersed nuclear weapons materials. Naturally occurring radionuclides include K-40 and the uranium and thorium series (including radon and progeny). The radionuclide composition of local area surface soil has been determined to be predominantly K-40, natural thorium, natural uranium, and their decay progeny. Radioactivity in nuclear weapons test fallout consists primarily of the fission-produced Sr-90, Cs-137, and Pu-239.

In 2000, 44 environmental soil samples were taken from several locations throughout the Area IV at SSFL. These locations were Old Conservation Yard (OCY), SCTI, SRE, 4373, and 4487. The soil samples were analyzed using the high-purity germanium (HPGe) multichannel analyzer (MCA) system for gamma emitters. Due to the fact that the 186.2 keV peak from Ra-226 and the 185.7 keV peak from U-235 are too close to separate by the HPGe counting system, the reported results for Ra-226 and U-235 should only be used as indicators for the concentrations of these two radionuclides. If abnormal results are observed, radiochemical analysis should be employed for determining the soil concentrations of these two radionuclides.

At the OCY, soil samples were taken in the vicinity of discovered metal debris to support RCRA remediation activities. At SRE and 4373, soil samples were taken during excavation of the septic tanks and leach fields at these two locations. In addition to soil samples, tank and pipe debris were also sampled and analyzed, and no activity was detected.

Table 5-9 summarizes the gamma spectrometry analysis results for the soil samples. In addition to the naturally occurring K-40, only trace amount of the man-made radionuclide, Cs-137, was detected in some samples. The maximum observed Cs-137 concentration is 0.3 pCi/gram, which is well below the site wide release limit of 9.2 pCi/gram for Cs-137.

5.2.5 Vegetation

Historically, Rocketdyne and its predecessor, Atomics International had sampled vegetation both on-site and off-site in the surrounding local community during the operational period from 1956 to 1989. In addition, Rocketdyne has sampled vegetation again during the site cleanup period since 1989. No evidence of any radioactive contamination in vegetation has ever been found.

In 2000, a concern was raised about brush fires in and around the contaminated sites such as the Santa Susana Field Laboratory (SSFL). The concern centered on the potential for brush and vegetation growing on contaminated land to become contaminated themselves, and subsequent fires could then result in airborne contamination, which could be a hazard to firefighters and the surrounding community.

Table 5-9. Environmental Soil Radioactivity Data—2000

		Activity (pCi/g)			
		K-40	**Cs-137**	**Ra-226**	**U-235**
OCY	Maximum	2.35E+01	2.68E-01	2.11E+00	1.28E-01
	Mean	1.99E+01	1.40E-01	8.72E-01	7.32E-02
	Minimum	1.58E+01	7.09E-02	3.54E-01	3.96E-02
	Number of Analyses[b]	16	16 (9)	16 (8)	16 (8)
SCTI	Maximum	1.87E+01	ND[a]	1.38E+00	8.35E-02
	Mean	1.87E+01	ND[a]	1.38E+00	8.35E-02
	Minimum	1.87E+01	ND[a]	1.38E+00	8.35E-02
	Number of Analyses[b]	1	1(1)	1	1
SRE	Maximum	2.85E+01	3.29E-01	1.82E+00	1.11E-01
	Mean	2.15E+01	1.63E-01	9.71E-01	6.05E-02
	Minimum	1.73E+01	6.24E-02	5.12E-01	3.05E-02
	Number of Analyses[b]	13	13 (10)	13 (9)	13 (9)
4373	Maximum	1.91E+01	1.55E-01	1.87E+00	1.13E-01
	Mean	1.60E+01	1.55E-01	1.56E+00	9.48E-02
	Minimum	4.69E+00	1.55E-01	1.28E+00	7.80E-02
	Number of Analyses[b]	9	9 (8)	9 (6)	9 (6)
4487	Maximum	2.48E+01	ND[a]	1.96E+00	1.19E-01
	Mean	2.07E+01	ND[a]	1.03E+00	7.66E-02
	Minimum	1.88E+01	ND[a]	6.67E-01	4.42E-02
	Number of Analyses[b]	5	5 (5)	5 (1)	5 (1)

[a]ND = Not detected

[b]Numbers in parentheses represent the number of analyses reported as less than the detectable limit

To better address this concern, Rocketdyne conducted another comprehensive vegetation sampling in Area IV at SSFL in 2000. There are 28 legacy radiological facilities in Area IV at SSFL, as shown in Figure 2-4. One composite vegetation sample was collected at each of these 28 facilities. At each location, vegetation samples were randomly collected throughout the area. Wherever possible, efforts were made to pick a variety of vegetation, such as leafs, stems, bushes, and/or grasses, at each location to make up the composite. Depending on the availability and types of vegetation, each composite sample weighted between 470 and 1530 grams. Since Buildings 4073 and 4093 were next to each other, and both of them were demolished, one composite sample was collected in that general area.

For comparison purposes, two off-site samples were collected to determine the natural background. These samples were collected from residential areas in West Hills and Westlake Village, respectively.

To best represent the brush fire scenario, the vegetation samples were measured for radioactive contaminants without washing and drying. Vegetation samples were placed in a plastic bag and analyzed in a HPGe detector for gamma emitters. Each sample was counted for 1,500 seconds to achieve low detection limits.

Table 5-10 summarizes the gamma spectrometry measurements of these vegetation samples. The only radionuclide found in these vegetation samples was naturally occurring potassium-40 (K-40), with concentrations ranging from below the MDA to 3.50 pCi/gram (wet weight). No man-made radionuclides were found in either on-site or off-site vegetation samples. Table 5-11 lists the minimum detection limits for typical gamma emitting radionuclides.

Having sampled and measured vegetation samples at every radiological facility in Area IV, we did not find any evidence of radioactive contamination in vegetation. This finding, once again, confirms the results from the previous vegetation sampling conducted by Rocketdyne and Atomics International.

5.2.6 Wildlife

No animal samples were collected in 2000.

5.2.7 Ambient Radiation

During the later years of the nuclear programs at Atomics International and Rocketdyne, from 1974 through 1989, the ambient radiation monitoring program used rather complicated bulb-type dosimeters (CaF_2:Mn). This was justified by the amount of nuclear materials handled in the operations at SSFL and De Soto, and by the low levels of radiation in the environment. At the termination of all nuclear work in 1989, such a program was no longer needed, and efforts were directed toward simplifying the program. This was done initially by using the same dosimeters (LiF) that were well established in use for personnel monitoring in radiation work. While these dosimeters are well suited to measuring exposures in the range of interest for compliance with occupational radiation regulations (doses "above background"), they are somewhat insensitive for environmental measurements since the resolution in terms of dose uses increments of 10 mrem per quarter. Using these dosimeters demonstrated that environmental exposures did not reach regulatory limits, but provided limited information on the actual exposure rates present around the facilities and in the neighboring environment.

In addition to the LiF TLDs discussed above, Rocketdyne began deploying, in the last quarter of 1995, environmental TLDs that use an aluminum oxide ("sapphire") chip. These TLDs are capable of determining doses in increments of 0.1 mrem (compared to 10 mrem for the LiF-based badges previously used). In addition, the aluminum oxide badge reporting is much more detailed, providing both gross and corrected readings for the locations. Proper use of the control badges supplied with these dosimeters allows elimination of the natural and transportation exposure that occurs before, during, and after the deployment of the environmental dosimeters to measure the ambient radiation. This permits accurate determination of the net exposure received while the environmental TLDs are in the field, exposed to the ambient radiation. In various intercomparisons, aluminum-oxide-based dosimeters have been shown to be among the most accurate dosimeters available in measuring environmental exposure rates.

The State DHS/RHB provides packages containing calcium sulfate ($CaSO_4$) dosimeters for independent monitoring of radiation levels at SSFL and in the surrounding area. These dosimeters are placed at specific locations along with the Rocketdyne TLDs. The State dosimeters are returned to the Radiologic Health Branch for evaluation. Data for these TLDs, which were placed at various Rocketdyne dosimeter locations both on-site and off-site, are also shown in Table 5-12 for 2000.

Table 5-10. Area IV Vegetation Sampling Results

Location	Sample ID	Wet Weight gram	K-40 pCi/g	K-40 MDA pCi/g
4486	ENV00089	470	2.78	0.88
4009	ENV00090	751	< MDA	1.39
4100	ENV00091	718	3.32	0.65
4020	ENV00092	563	3.28	0.74
4363	ENV00093	670	3.50	0.70
4373	ENV00094	743	1.99	0.56
4055	ENV00096	747	2.33	0.56
4011	ENV00097	1040	< MDA	0.93
17th St Drainage	ENV00098	508	< MDA	1.80
4005	ENV00099	1035	2.14	0.51
4023	ENV00100	938	< MDA	1.30
4073/4093	ENV00102	699	< MDA	1.57
4029	ENV00103	954	< MDA	1.15
4030	ENV00105	1530	< MDA	0.52
4064	ENV00106	557	< MDA	2.03
4064 S/Y	ENV00107	666	< MDA	1.48
OCY	ENV00108	489	< MDA	2.35
4003	ENV00109	801	1.46	0.65
SRE	ENV00110	758	3.46	0.55
4654	ENV00111	677	< MDA	1.84
RMHF	ENV00112	716	< MDA	1.24
4024	ENV00113	800	2.34	0.65
4028	ENV00114	824	3.01	0.58
4010	ENV00116	992	2.45	0.50
4012	ENV00117	1090	1.71	0.43
4019	ENV00118	674	< MDA	1.55
4059	ENV00119	847	< MDA	1.32
West Hills	ENV00126	1244	1.32	0.29
Westlake Village	ENV00127	852	< MDA	1.27

Table 5-11. Vegetation Sample Minimum Detectable Activities (MDA)

Location	Sample ID	MDA, pCi/gram					
		Mn-54	Co-60	Cs-137	Eu-155	Pb-210	Ra-226
4486	ENV00089	8.32E-02	8.30E-02	7.24E-02	1.06E-01	6.52E-01	1.30E+00
4009	ENV00090	4.31E-02	6.44E-02	4.74E-02	6.60E-02	3.85E-01	7.13E-01
4100	ENV00091	5.45E-02	4.86E-02	5.35E-02	8.16E-02	4.36E-01	9.28E-01
4020	ENV00092	6.42E-02	5.36E-02	5.45E-02	9.92E-02	5.32E-01	1.15E+00
4363	ENV00093	5.87E-02	5.69E-02	5.74E-02	7.89E-02	4.10E-01	8.38E-01
4373	ENV00094	4.87E-02	5.13E-02	5.53E-02	7.51E-02	4.34E-01	8.06E-01
4055	ENV00096	6.02E-02	5.23E-02	4.11E-02	7.07E-02	3.96E-01	8.33E-01
4011	ENV00097	3.63E-02	3.01E-02	3.27E-02	5.08E-02	2.81E-01	5.82E-01
17th St Drainage	ENV00098	6.79E-02	8.07E-02	6.04E-02	9.27E-02	4.50E-01	1.05E+00
4005	ENV00099	3.15E-02	3.38E-02	3.71E-02	4.96E-02	3.27E-01	5.79E-01
4023	ENV00100	3.86E-02	4.54E-02	3.45E-02	5.64E-02	3.12E-01	6.76E-01
4073/4093	ENV00102	4.67E-02	6.99E-02	6.06E-02	8.87E-02	4.34E-01	7.94E-01
4029	ENV00103	4.72E-02	3.66E-02	3.57E-02	4.55E-02	3.28E-01	7.15E-01
4030	ENV00105	1.86E-02	2.49E-02	2.85E-02	3.60E-02	1.82E-01	4.53E-01
4064	ENV00106	5.12E-02	6.28E-02	4.81E-02	9.90E-02	5.50E-01	1.12E+00
4064 S/Y	ENV00107	5.93E-02	4.06E-02	5.11E-02	8.06E-02	4.18E-01	8.99E-01
OCY	ENV00108	6.28E-02	9.44E-02	6.27E-02	1.05E-01	6.06E-01	1.05E+00
4003	ENV00109	4.53E-02	5.45E-02	3.60E-02	6.20E-02	3.43E-01	8.05E-01
SRE	ENV00110	3.77E-02	6.44E-02	4.28E-02	6.55E-02	3.77E-01	8.79E-01
4654	ENV00111	5.11E-02	7.16E-02	6.07E-02	7.22E-02	4.32E-01	8.39E-01
RMHF	ENV00112	4.83E-02	4.22E-02	4.53E-02	6.46E-02	4.04E-01	9.38E-01
4024	ENV00113	5.81E-02	4.38E-02	3.83E-02	6.71E-02	3.48E-01	7.92E-01
4028	ENV00114	3.98E-02	6.15E-02	3.93E-02	6.60E-02	3.24E-01	7.12E-01
4010	ENV00116	3.99E-02	4.93E-02	4.14E-02	4.66E-02	2.81E-01	6.72E-01
4012	ENV00117	2.83E-02	4.24E-02	2.97E-02	4.48E-02	2.41E-01	5.66E-01
4019	ENV00118	5.88E-02	6.33E-02	5.05E-02	7.50E-02	3.59E-01	8.43E-01
4059	ENV00119	4.68E-02	5.04E-02	5.28E-02	5.46E-02	3.10E-01	6.71E-01
West Hills	ENV00126	3.01E-02	3.68E-02	2.86E-02	4.42E-02	2.21E-01	5.05E-01
Westlake Village	ENV00127	4.20E-02	4.09E-02	5.11E-02	6.19E-02	3.43E-01	7.95E-01

Table 5-12 shows that radiation exposures measured by Rocketdyne and the State DHS are slightly different. This is mainly due to the fact that two different types of TLDs were used in the measurement. Radiation doses measured at locations SS-12, -13, -14 and -15, are slightly higher than the rest of the locations on-site. This is reflective of normal operations at the RMHF, which involve handling and shipment of radioactive waste.

The natural background radiation level as measured by the off-site TLDs ranges from 31 to 58 mrem/yr. At SSFL, the local background ranges from 64 to 86 mrem/yr, based on the data from dosimeters SS-3, -4, -6, -7, -8, -9, -11, and EMB-1 and EMB-2 as shown in Table 5-12. The variability observed in these values can be attributed to differences in elevation and geologic conditions at the various sites. The altitude range for the dosimeter locations is from approximately 260 m (850 ft) ASL at the off-site locations to a maximum of approximately 580 m (1,900 ft) ASL at SSFL. Many SSFL TLD locations are also affected by proximity to sandstone rock outcroppings, which results in elevated exposure levels.

Table 5-12. 2000 SSFL Ambient Radiation Dosimetry Data

2000 TLD-Locations		Annual Exposure (mrem) by Rocketdyne	Average Exposure Rate (µR/h)	
			Rocketdyne	State DHS[a]
SSFL	SS-3	64.3	7.3	6.7
	SS-4	69.9	8.0	7.5
	SS-6	69.8	8.0	8.4
	SS-7	71.0	8.1	8.1
	SS-8	70.2	8.0	9.0
	SS-9	82.9	9.5	8.2
	SS-11	86.1	9.8	8.2
	SS-12	93.8	10.7	11.0
	SS-13	97.1	11.1	11.4
	SS-14	79.8	9.1	9.9
	SS-15	82.0	9.4	9.9
	EMB-1	86.1	9.8	8.5
	EMB-2	74.4	8.5	8.1
Mean Values		**78.7**	**9.0**	**8.8**
Off-site	OS-1	57.8	6.6	6.0
	BKG-11	49.8	5.7	--
	BKG-12	31.4	3.6	--
	BKG-13	34.5	3.9	--
	BKG-15	49.1	5.6	--
	BKG-18	49.8	5.7	--
	BKG-19	44.9	5.1	--
	BKG-22	42.6	4.9	--
Mean Values		**45.4**	**5.2**	**6.0**

a: State DHS exposure rates are based on the first three quarters. The 4th quarter data is not available.

The external exposure rate at Rocketdyne's northern property boundary, the closest property boundary to the RMHF, was indistinguishable from natural background. This property line is approximately 300 meters from the RMHF and separated by a sandstone ridge, effectively shielding the boundary from any direct radiation from the RMHF. Dosimeters placed on the RMHF side of this sandstone ridge (SS-12, -13, –14, and -15), approximately 150 meters from the RMHF, read an average of 13 mrem/yr above local background. This is considerably below DOE's 100 mrem/yr limit specified in DOE Order 5400.5 "Radiation Protection of the Public and the Environment." The TLD results demonstrate that the potential external exposure at the site boundary is below the DOE's dose limit.

5.3 ESTIMATION OF RADIATION DOSE

5.3.1 Individual Dose

The total effective dose equivalent (TEDE) to any member of the public from all pathways (combining internal and external dose) shall not exceed 100 mrem/yr (above background) for DOE facilities. Although the four TLD monitoring stations to the north of the RMHF, namely SS-12, -13 –14, and -15, recorded an external dose level at 13 mrem above the local background, the actual dose at the property boundary is likely to be indistinguishable from the natural background. This is because the high rocky terrain between the actual property line and the TLD monitoring stations acts as an effective shield and makes the exposure from direct radiation at the property line indistinguishable from background. Exposure from direct radiation at the nearest residence would also be indistinguishable from background for the same reason.

Estimates of the internal dose from airborne releases assume a constant unsheltered exposure throughout the year, adjusted for wind direction frequency, and, therefore, considerably overestimate the actual annual averaged doses near the site. Estimated internal radiation doses due to atmospheric emission of radioactive materials from SSFL nuclear facilities are calculated using the EPA program CAP88-PC, and are many orders of magnitude below the radiation standards and are far below doses from internal exposure resulting from natural radioactivity in air. For the air pathway only, for DOE operations, the standard is 10 mrem/yr for committed effective dose equivalent, as established by EPA.

Table 5-13 shows the public exposure to radiation and radioactivity. The table presents the estimated exposures in comparison to the regulatory standards. Dose values in the table represents both internal and external exposures.

Table 5-13. Public Exposure to Radiation from DOE Operations at SSFL—2000

1.	All pathways	
	a. Maximum estimated external dose to an individual from direct radiation	0 mrem/yr
	b. Maximum estimated internal dose to an individual	7.7×10^{-7} mrem/yr
	Limit	100 mrem/yr
	("Radiation Protection of the Public and the Environment" DOE Order 5400.5)	
2.	Air pathway (reported in NESHAPs report)	7.7×10^{-7} mrem/yr
	Limit (40 CFR 61, Subpart H)	10 mrem/yr

5.3.2 Population Dose

The general population (person-rem) dose estimates were calculated using CAP88-PC code. This code uses release rate, wind speed, wind direction and frequency, stability fractions, and stack height parameters as input data. Population dose is estimated to be 2.2×10^{-4} person-rem for the SSFL site. This may be compared to the total population dose within 80 km radius from 300 mrem/yr of natural background radiation of 3×10^{6} person-rem. In spite of the large number of people in the surrounding population, the population dose estimated for Rocketdyne operations is extremely small. Figure 5-3 shows the updated population data within 50 miles (80 km) radius from SSFL.

Figures 5-4 and 5-5 show more detailed local population distribution estimated from the latest demographic survey by Claritas Inc. Claritas Inc, a leading demographic survey company, developed the demographic data around SSFL in 2000 based on the census data and modified by direct observations of nearby residential areas around the SSFL site.

Figure 5-3. Updated Demographic Data (2000) within 50 Miles (80 km) of SSFL

CP01-9400-10

Figure 5-4. Number of Persons Living within 5 Miles (8 km) from SSFL Site (2000)

CP01-9400-11

Figure 5-5. Number of Persons Living within 10 Miles (16 km) from SSFL Site (2000)

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6. ENVIRONMENTAL NON-RADIOLOGICAL MONITORING

Rocketdyne maintains a comprehensive environmental program to ensure compliance with all applicable regulations, to prevent adverse environmental impact, and to restore the quality of the environment from past operations.

The discharge of surface water at SSFL results from collection of rainfall runoff or is due to the nonutilization of treated groundwater and is regulated by the California Regional Water Quality Control Board through an NPDES permit. The majority of surface water runoff drains to the south and is collected in the water reclamation/pond system. Discharges from this system are subject to effluent limitations and monitoring requirements as specified in the existing NPDES permit. A small portion of the site within Area IV generates rainfall runoff to five northwest runoff channels where monitoring locations (Figure 6-1) have been established and sampling is conducted in accordance with the northwest slope monitoring program. All discharges are periodically monitored for volatile organics, heavy metals, and applicable radionuclides (see section 5.2.3), in addition to other parameters necessary to assess water quality.

All air emission sources at SSFL are subject to the provisions of the Clean Air Act as administered through the California Air Resources Board and the Ventura County Air Pollution Control District (VCAPCD). The VCAPCD regulates sources of air emissions and issues permits containing limits on pollutant levels and conditions of operation.

An extensive site-wide (SSFL) groundwater remediation program has the capacity for removing solvent contamination from approximately 10 million gallons of groundwater per month at SSFL. The major groundwater contaminant in Area IV is TCE and its degradation products. Three interim groundwater extraction system wells have been installed in Area IV and evaluation of their performance is in progress. The overall annual groundwater monitoring program at SSFL addresses collection and analysis of groundwater samples and measurement of the water levels for the 247 Rocketdyne installed wells on-site and off-site and 16 off-site private wells. The locations of these wells within and around DOE areas in Area IV are shown on the map of SSFL in Figure 6-2. Groundwater quality parameters and sampling frequency have been determined based on historical water quality data, location of known or potential sources of groundwater contamination, operational requirements of groundwater extraction and treatment systems and regulatory direction. The groundwater monitoring program includes the following parameters, all analyzed using the appropriate EPA methods: volatile organic constituents, base/neutral and acid extractable organic compounds, petroleum hydrocarbons, and trace metals and common ion constituents. Radiological analyses are performed on groundwater samples from DOE areas in Area IV and off-site (Section 5.2.2).

Petroleum hydrocarbon contaminated soils resulting from underground storage tanks (UST) have been remediated as tanks are removed. The majority of the storage tanks have been removed. The few remaining USTs contain either sodium or radioactive water and are located within concrete vaults and equipped with automatic leak detection systems. As stated previously, these tanks are exempt from the UST regulations.

Figure 6-1. Locations of Surface Water Runoff Collectors

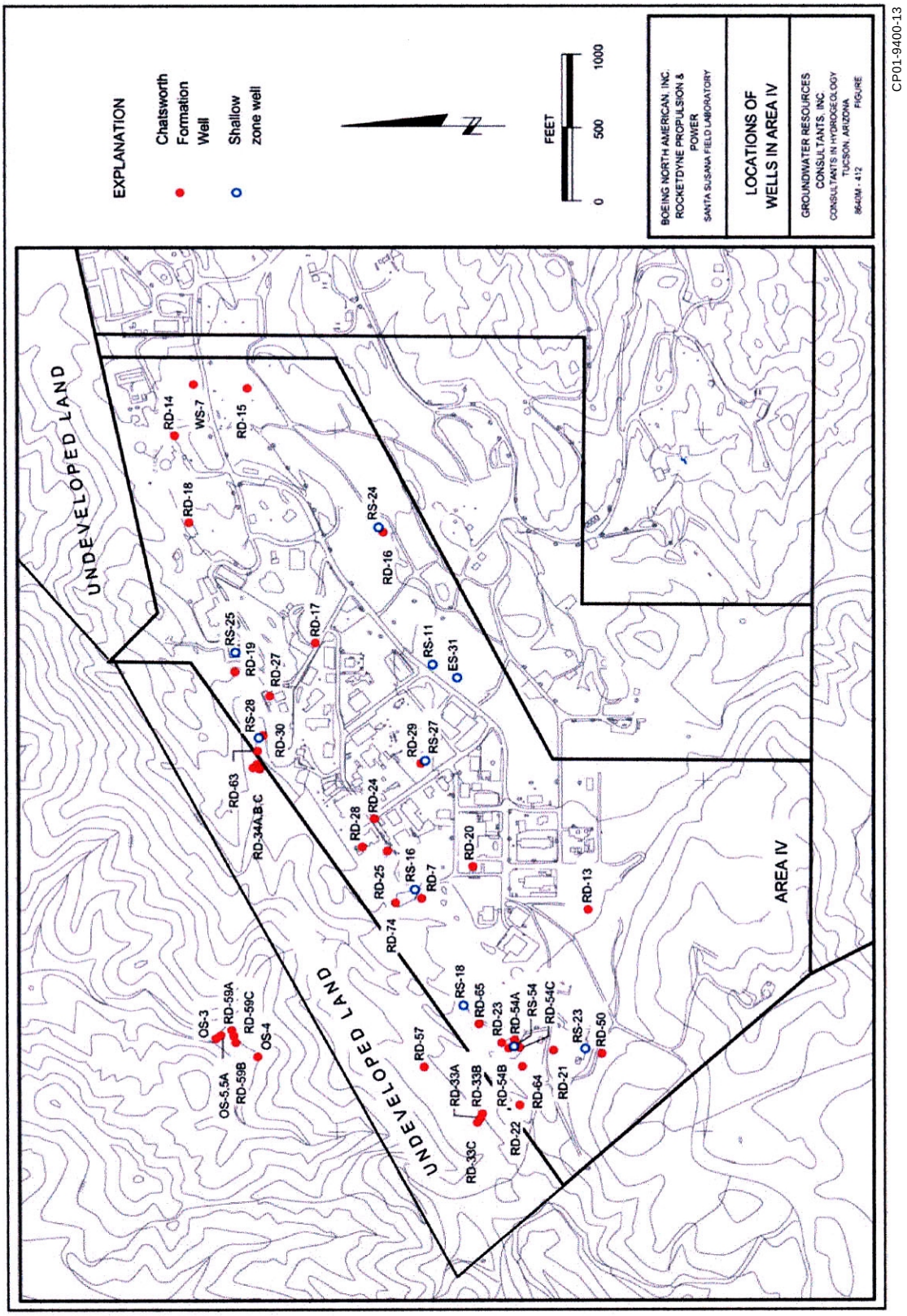

Figure 6-2. Location of Wells Used in Groundwater Management Program

6.1 SURFACE WATER

Rocketdyne has filed a Report of Waste Discharge with the California Regional Water Quality Control Board and has been granted a discharge permit pursuant to the National Pollutant Discharge Elimination System and Section 402 of the federal Water Pollution Control Act. The permit to discharge, NPDES No. CA0001309, initially became effective September 27, 1976, and was most recently renewed on June 29, 1998. The current permit is in effect through May 10, 2003.

The permit allows the discharge of reclaimed wastewater and storm water runoff from water retention ponds into Bell Creek, a tributary to the Los Angeles River, in addition to the discharge of storm water runoff from the northwest slope (Area IV) locations. Discharge along the northwest slope (RMHF: Outfall 003, SRE: Outfall 004, FSDF 1: Outfall 005, FSDF 2: Outfall 006, and 4100: Outfall 007) generally occurs only during and after periods of heavy rainfall. The permit applies the numerical limits for radioactivity in drinking water supplies to drainage through these outfalls. Excess reclaimed water is discharged on a continuous basis from the R-2A Pond that ultimately releases through Outfall 002.

There is no sanitary sewer connection to a publicly owned treatment works from SSFL. Domestic sewage is treated, disinfected, and discharged to the retention ponds. Permit conditions are placed on the operation of the two treatment plants. Area IV sewage is piped directly to the Area III Sewage Treatment Plant (STP III).

Of the two retention ponds at SSFL that discharge via the NPDES permit, only one receives influent from Area IV, and is referred to as R-2A Pond. Influent to the ponds includes tertiary treated domestic sewage, cooling water from various testing operations, treated ground water and storm water runoff. During periods of discharge from the ponds, grab samples are collected and sent to a California State-certified testing laboratory for analysis. Analyses include chemical constituents such as heavy metals, volatile organics, base/neutral and acid extractables, and general chemistry. Radiological analyses include gross alpha and gross beta activities, Sr-90 and tritium concentrations. Toxicity testing is also conducted in the form of acute and chronic toxicity bioassays.

The permit imposes the contaminant limits for drinking water suppliers, relative to radioactivity, and goes beyond the requirements of the drinking water supplier regulations in requiring more frequent sampling and analysis. During wet weather flow (when rainfall is greater than 0.1 inch) no more than one sample per 2 weeks needs to be obtained from each outfall. During dry weather flow, whenever there is discharge, minimum sampling frequency for Outfall 002 is once per month.

In 2000, Outfalls 002, 003, 004, 005, 006, and 007 all had incidents of noncompliance.

6.1.1 Outfall 002 (R-2A Pond Discharge)

Outfall 002 had five apparent incidents of noncompliance in 2000. Of those, four resulted from apparent laboratory errors and/or were collected from a flow stream that dried up before leaving Boeing property. The other one resulted from low flow sampling conditions in an unlined channel. Analytical results from the sampling at the Outfall 002 weir in June reported

lead, cadmium, and total suspended solids to be present at levels above the permitted monthly average limits. All analytical results from follow up samples indicate lead and cadmium to be within permitted limits. In addition, results for the cadmium analyses are questionable. In the June 30, 2000 analysis, the laboratory also detected cadmium in their blank at 1.0 µg/L. Subtracting out the amount found to be present in the blank provides a result of 0.1 µg/L, which is more consistent with historical sampling data. Using this corrected value, the monthly average becomes 0.6 µg/L, which is in compliance with the permitted guideline. Analytical results from samples collected directly from the pond also reported nondetectable levels. No industrial source could be identified and the analytes have not been detected in any follow-up sampling events. Efforts will continue to identify and eliminate any industrial sources. The monthly average limit of 15 mg/L for total suspended solids was also exceeded. In warmer months, there is a decrease in the overall volume of water being discharged off the property. The flow stream at the Outfall 002 weir is diminished to a trickle and often disappears entirely making proper sampling difficult. Sediment from the unlined drainage channel can be inadvertently collected along with the sample water resulting in elevated levels of suspended solids being present in the sample. The result is, therefore, not necessarily representative of the suspended solids level leaving the site. Additionally, since June's samples were collected at the weir due to a lack of flow at the property line, no discharge left Boeing property. Efforts will continue to identify and eliminate any industrial sources.

The permitted monthly average limits of 15 mg/L for total suspended solids, was also exceeded for the month of September. As mentioned above, in the warmer months, there is a decrease in the overall volume of water being discharged off the property. The flow stream at the Outfall 002 flume is diminished to a trickle making proper sampling difficult. Sediment from the unlined drainage channel can be inadvertently collected along with the sample water resulting in elevated levels of suspended solids being present in the sample. The result is, therefore, not necessarily representative of the suspended solids level leaving the site.

Also in September, the daily maximum limit of 2.1 µg/L for dissolved mercury was exceeded with a contract laboratory reported value of 4.7 µg/L. However, these results are not believed to be accurate as a re-analysis of this same sample yielded a result of 1.5 µg/L. Unfortunately, the re-analysis was not performed within the acceptable hold time of the sample and was, therefore, not used for reporting.

6.1.2 Outfall 003 (RMHF)

Outfall 003 had one incident of noncompliance in 2000. Analytical results from the February sampling events reported total recoverable mercury to be present at levels above the permitted monthly average of 0.012 µg/L. Results from the dissolved mercury analysis were at nondetectable levels. Standard methods for total metals analysis requires the digestion of all matter collected in the sample, including sediment. As mentioned in the monthly reports, mercury has been detected in some soil samples collected at the facility. Sediment control structures were installed and appear to be effective, they will continue to be maintained and modified as necessary to control sediment migration.

6.1.3 Outfall 004 (SRE)

Outfall 004 had two incidents of noncompliance in 2000. Analytical results from February and April sampling events reported total recoverable mercury to be present at levels above the permitted monthly average of 0.012 µg/L or, where applicable, the calculated permitted monthly average of 0.05 µg/L. Standard methods for total metals analysis require the digestion of all matter collected in the sample, including sediment. Mercury has been detected in soil samples collected at the facility – this area is currently under investigation/remediation through the oversight of the Department of Toxic Substances Control (DTSC). Boeing is awaiting approval of an RCRA interim measure by the DTSC, which will allow the removal of mercury-contaminated soil believed to be the source of mercury in the surface water at this outfall. Sediment traps (weirs, hay bails, and filter cloth) have been installed in the drainage channels as an interim control before completing remedial activities. The sediment control structures will continue to be maintained and modified as necessary to control sediment migration.

6.1.4 Outfall 005 (FSDF 1)

Outfall 005 had four incidents of noncompliance in 2000, at which one is believed to be a laboratory error and one was taken from a sample flow that is believed to have not left Boeing property. A discussion of each can be found below.

Analytical results for samples collected in January, February, and March indicated total recoverable mercury to be present at levels above the permitted monthly average of 0.012 µg/L or, where applicable, the calculated permitted monthly average of 0.05 µg/L (the calculated monthly average was performed per Section A.3.b footnote 4 using the contract laboratory's method detection limit of 0.05 µg/L). Standard methods for total metals analysis require the digestion of all matter collected in the sample, including sediment. Mercury has been detected in soil samples collected at this facility - an area that was under remediation by the oversight of the DTSC. Sediment traps (weirs, hay bails, and filter cloth) were installed in the drainage channel as an interim control before completing remedial activities. The sediment control structures continue to be maintained and modified as necessary to control sediment migration. The Former Sodium Disposal Facility (FSDF) RCRA interim measures remediation project was approved by the DTSC to remove contaminated soil believed to be a source of mercury in the surface water. Excavation was completed in April 2000.

Specifically for the analytical results from the January 25, 2000 sampling at Outfall 005, the water sample collected was representative of the storm water that had accumulated on the top of the tarp covering the FSDF. The January 25 storm was relatively small, producing only 0.11 inch of rain, and did not produce enough rain to generate runoff if the area was not covered. In addition, it is unlikely the small volume of runoff left Rocketdyne property because of the presence of the sediment traps and weir downstream of the sampling point combined with the large distance to the property boundary.

Additionally at Outfall 005, analytical results for a sample collected in March indicated dissolved thallium to be present above the permitted daily maximum limit. All analytical results from samples collected at the outfall both before and after this time, indicate dissolved thallium to be within permitted limits. No industrial source of thallium could be identified on site. As

thallium has never been detected in surface water at this sampling location, and we were unable to duplicate the results in follow-up sampling, the result is believed to be an anomaly or laboratory error.

6.1.5 Outfall 006 (FSDF 2)

Outfall 006 had two incidents of noncompliance in 2000, of which one is believed to be a laboratory error. Analytical results from the February sampling event reported total mercury to be present at levels above the permitted monthly average of 0.012 µg/L. Standard methods for total metals analysis requires the digestion of all matter collected in the sample, including sediment. As with Outfall 005, mercury has been detected in soil samples collected at this facility - an area that was under remediation by the oversight of the DTSC. Sediment traps (weirs, hay bails, and filter cloth) were installed in the drainage channel as an interim control before completing remedial activities. The sediment control structures continue to be maintained and modified as necessary to control sediment migration. The FSDF RCRA interim measures remediation project was finally approved by the DTSC to remove contaminated soil believed to be a source of mercury in the surface water. Excavation was completed in April 2000.

Also at Outfall 006, analytical results for a sample collected in March indicated oil and grease to be present above the permitted daily maximum limit. All analytical results from samples collected at the outfall both before and after this time, indicate oil and grease to be within permitted limits. Oil and grease has historically been in compliance at this sampling location and no industrial source is present. The analytical method used involves hexane, which dissolves potential contaminants such as natural skin oils. This is believed to be an anomaly or laboratory error, as the analytical results were not supported by historical data and unable to be duplicated in follow-up sampling events.

6.1.6 Outfall 007 (Building 4100)

Outfall 007 had three incidents of noncompliance in 2000, of which two are believed to be either an anomaly and/or laboratory error. Analytical results from the February sampling events reported total recoverable mercury to be present at levels above the permitted monthly average of 0.012 µg/L. Standard methods for total metals analysis requires digesting all matter collected in the sample, including sediment. Mercury has been detected in some soil samples collected at the facility. Sediment control structures (weirs, hay bails, and filter cloth) were installed and appear to be effective. They will continue to be maintained and modified as necessary to control sediment migration.

Additionally at Outfall 007, analytical results for a sample collected in February reported dissolved copper to be present at levels slightly above the permitted monthly average limit. This result is believed to be an anomaly or laboratory error as neither an industrial source can be identified nor has the analyte been detected in previous or follow up sampling events.

Also at Outfall 007, analytical results from the March sampling showed antimony to be present above the permitted daily maximum limit. Additional analyses were performed on the same digestate and the same sample with varying results, including antimony being present in the blanks. Subtracting out the amount found to be present in the blanks in subsequent samples, results ranged from 1.1 to 2.0 µg/L, which is more consistent with historical sampling data at this

location. Follow-up sampling was performed and continued compliance was demonstrated. Again, this appears to be a laboratory error.

6.2 AIR

Air pollutant discharge limitations are imposed by VCAPCD (Ventura County Air Pollution Control District) Rules and Regulations and Permit to Operate (P/O) 0271 for this area. P/O 0271 is kept current and renewed each year by VCAPCD.

At present, the sodium treatment facility (Bldg 4133) and the ethanol cleaning operation at SPTF (Bldg 4463) are the only permitted stationary sources for the area. Most stationary sources that were included in P/O 0271 have been deleted in the past few years since they became inactive and/or were demolished. Moreover, although Building 4133 still remains permitted, it has been in closure since June 1998.

Lastly, because of the small quantity of air emissions emitted from sources covered under P/O 0271, the area is a non-Title V, non-Aerospace NESHAP and non-SARA313 stationary source, since it has continued to remain below the applicable thresholds.

6.3 GROUNDWATER

A groundwater monitoring program has been in place at the SSFL site since 1984. Currently, the monitoring system includes 247 Rocketdyne installed on-site and off-site wells and 16 private off-site wells. Routine quarterly chemical and radiological monitoring of the wells is conducted according to the monitoring plan submitted to the lead agency for the groundwater program. Quarterly reports are submitted to the regulatory agencies at the end of the first three quarters. An annual report is submitted to the agencies after the monitoring for the fourth quarter is completed.

The groundwater at SSFL exists in two geologic units: Shallow Zone and the Chatsworth Formation. The Shallow Zone is an unconfined system in the alluvium (surface mantle soils) of the Burro Flats area and along the major drainage channels. The alluvium is composed of a heterogeneous mixture of gravel, sand, silt, and clay. Water levels in the alluvium respond to recharge resulting from precipitation and runoff, and may vary considerably between wet and dry periods. Within Area IV, there are 10 DOE-sponsored Shallow Zone wells. The Chatsworth formation is composed of consolidated, massively bedded sandstones with interbedded layers of siltstone and claystone. The formation may be as thick as 6,000 ft at the SSFL site. The regional direction of groundwater flow in the formation is probably radially off-site toward the surrounding lowlands. The permeability of the Chatsworth formation is very low except along open fractures. Groundwater within the fractured Chatsworth formation occurs mostly under confined conditions. There are 37 DOE-sponsored wells in and around Area IV in the Chatsworth formation.

The solvents found in the groundwater include trichloroethylene (TCE) and its family of degradation products. The 2000 analyses results of the Area IV wells have been documented in 2000 Annual Groundwater Monitoring Report [HA 2001].

Three existing areas of TCE contamination in groundwater in the northwest part of Area IV were monitored in 2000. These areas are shown in Figure 6-3, where areas of suspected contamination equal to or above the State action level of 5 µg/L are shown as cross-hatched. The central occurrence may also extend laterally; however, no data are available because this area is located in inaccessible terrain.

The TCE occurrence associated with the RMHF canyon (the northern occurrence) has been detected in the Shallow Zone and Chatsworth formation wells. The Shallow Zone well RS-28, which contained TCE concentrations up to 87 µg/L historically, contained TCE concentration of 13 µg/L in 2000. The Chatsworth formation well RD-30 contained 12 to 15 µg/L of TCE in 2000. RD-63, an extraction well installed in 1994 in the Chatsworth formation for the pilot extraction test in the area, detected 6.6 to 8.5 µg/L TCE in 2000.

Within the central contaminated area (Figure 6-3) southwest of 4059, the Chatsworth formation well RD-7 contained TCE concentration from 64 to 81 µg/L in 2000 compared to 48 to 56 µg/L in 1999. Since its construction in 1986, RD-7 generally contained TCE concentrations in the 16 to 56 µg/L range with a maximum TCE concentration of 130 µg/L. RD-25, located southwest of 4059, continued to contain perchloroethane (PCE). In 2000, the well contained

5.9 to 6.9 µg/L PCE, compared to 10 to 19 µg/L PCE in 1999. TCE was also detected in samples from RD-25 in 2000, but were below the State action level of 5 µg/L.

Groundwater samples from two Shallow Zone wells (RS-18 and RS-54) within the southern contaminated area (Figure 6-3) near the FSDF at the western end of the site contained elevated TCE concentrations. TCE in RS-54 ranged from 180 to 4,500 µg/L between 1993 and 1999. In 2000, TCE concentration was 1,500 µg/L. RS-18, often dry since its construction in 1985, recorded TCE at 19 µg/L to 3,200 µg/L during the period from 1993 to 1999. RS-18 contained 170 µg/L TCE in 2000. RD-21 and RD-23, two Chatsworth formation wells installed in 1989 at the FSDF, contained TCE ranging up to 2,900 µg/L. In 2000, TCE in these wells ranged from 220 to 610 µg/L. RD-33A, a Chatsworth formation well (shallowest well of a three-well cluster constructed in 1991), contained 5.7 to 8.2 µg/L TCE in 2000, compared to 2.4 to 9.8 µg/L in the period from 1993 to 1999. RD-65, a Chatsworth formation well located northeast of the FSDF contained 680 µg/L TCE in 2000. TCE in this well was up to 960 µg/L historically. Because of the excavation activities at FSDF, groundwater samples could not be collected at some wells during the later part of 2000.

The pilot extraction test at RMHF included installing an extraction well and treating the extracted water in a portable carbon adsorption treatment unit. Results indicated that groundwater extraction in the test well at RMHF was effective in creating a capture zone for degraded groundwater. Groundwater extraction is also conducted in three wells (RD-24, RD-25, and RD-28) surrounding the Building 59 area. This extraction is primarily to dewater the building basement. At FSDF, cyclic pumping of one to three wells continues at the site. Extraction and treatment of contaminated groundwater continued on an interim basis at RMHF, Building 59, and the FSDF in 2000. Groundwater from these sites is treated by liquid-phase carbon adsorption and is released southward to the surface water collection system, which is under the NPDES permit for discharge. The extraction activity at the FSDF was initiated in 1995, RMHF in 1994, and Building 59 in 1995. To date, approximately 118,000 gallons, 2.7 million gallons, and 1.9 million gallons of groundwater have been treated from FSDF, RMHF, and Building 59 areas, respectively.

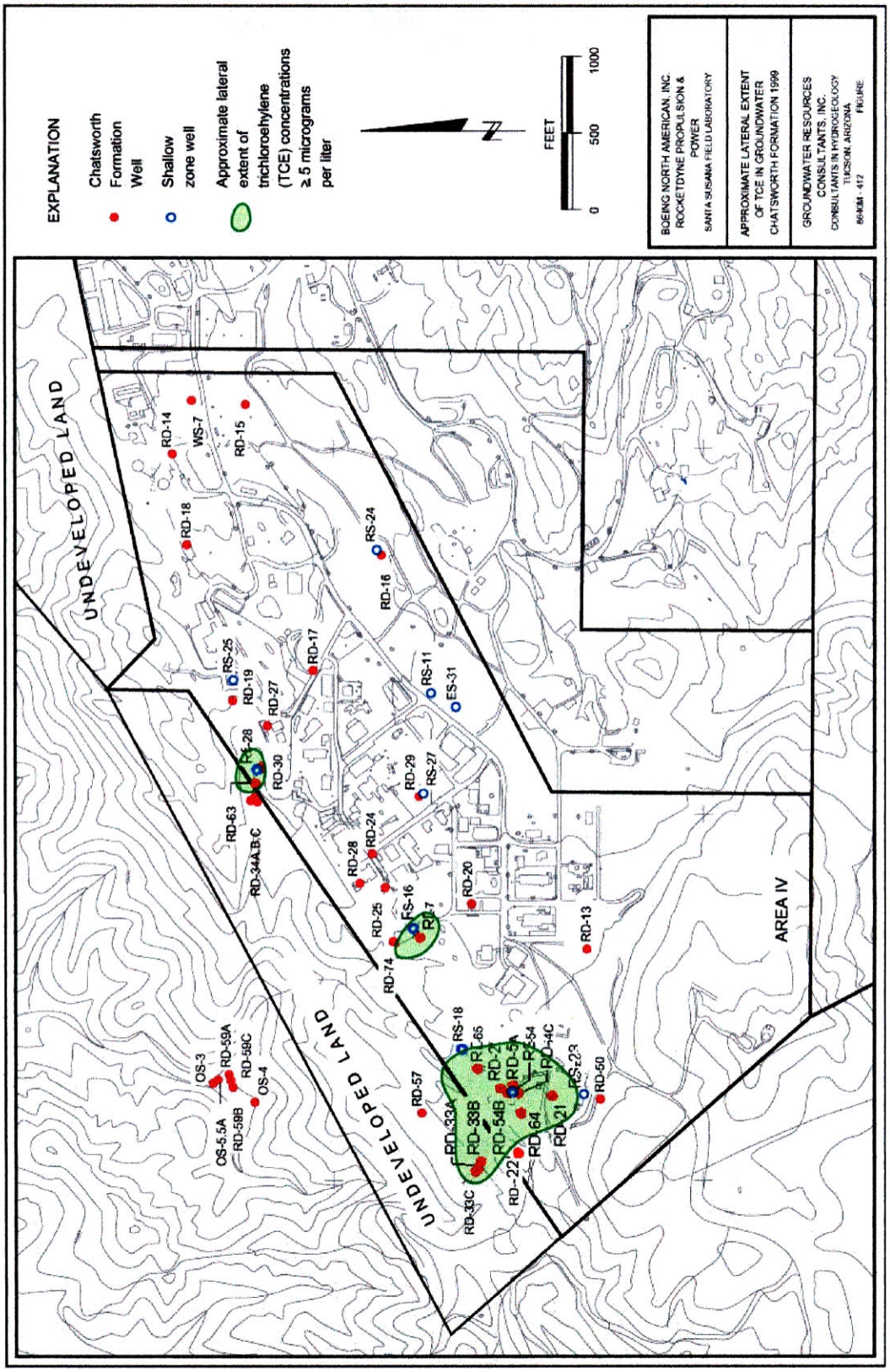

Figure 6-3. TCE Occurrences in Groundwater at SSFL, Area IV (exceeding 5 ppb)

6.4 RCRA FACILITY INVESTIGATION

The RCRA Facility Investigation (RFI) Program started at the SSFL site in 1996 and is presently ongoing. RFI field work will be completed in 2002, and the draft report prepared and submitted in 2003.

The primary objectives of the RFI at the SSFL are to (1) investigate the nature and extent of chemicals in soil and the potential threat to groundwater quality for each SWMU and AOC identified for potential RFI Corrective Action, and (2) evaluate the potential risk to human health and the environment presented by these SWMUs and AOCs to assess whether remediation is required. The resulting data will then be evaluated following DTSC approved risk assessment methodologies to evaluate whether remediation, additional assessment, or no further action is necessary to bring each site to closure.

Field methodologies for the investigation include soil matrix sampling, soil vapor sampling, surface water sampling, and trenching. DTSC was on-site during much of the fieldwork to observe sampling protocols and select sampling locations and depths. Field action levels (FAL) were developed before sampling in conjunction with DTSC risk assessors for use as soil screening values during the field program. They were calculated to be chemical concentrations in soil that would not pose a threat to human health or groundwater quality.

Some key activities in the year 2000, include completion of the Former Sodium Disposal Facility (FSDF) Interim Measure, investigation of several SWMUs and AOCs, and submittal and approval of the RCRA Facility Investigation Work Plan Addendum Amendment (WPAA).

The RFI WPAA describes additional characterization requested by DTSC at four DOE sites. Fieldwork to implement the WPAA began June 28, 2000. The four sites described in the WPAA include:

- Building 20, Rockwell International Hot Laboratory (RIHL), SWMU 7.7
- Building 59, Systems for Nuclear Auxiliary Power (SNAP) Facility, Area IV AOC
- Building 65, Metals Laboratory Clarifier, Area IV AOC
- Building 457, Former Hazardous Materials Storage Area (HMSA), Area IV AOC

The Standardized Risk Assessment Methodology (SRAM) for the surficial operable unit was approved by DTSC on June 6, 2000. The SRAM will be used to conduct risk assessments for DOE sites during 2001 and 2002.

During 2000, approximately 70 soil matrix, 3 soil vapor, and 2 surface water samples were collected. To date, approximately 22 soil vapor (22 analyses) and 193 soil matrix samples (640 analyses) have been collected from DOE locations during the RFI program (Table 6-1).

Table 6-1. Soil Sampling for RCRA Facility Investigation

RFI Sampling Period	Soil Matrix Samples	Soil Matrix Analyses	Soil Vapor Samples	Soil Vapor Analyses	Surface Water Samples	Surface Water Analyses
11/06/99-11/15/00	70	113	3	3	2	2
Total to date	193	640	22	22	2	2

RFI analytical results for samples collected during 1999 and 2000 have not been published or validated at the time of publication of 2000 ASER. RFI data collected before 1999, however, has been published and validated. The data presented in Table 6-2 is a summary of soil sample results from the Building 56 Landfill (SWMU 7.1) and the Old Conservation Yard (SWMU7.4) that exceed FALs.

Table 6-2. Soil Analysis Summary for RCRA Facility Investigation

Analytes	Field Action Levels (FAL)	B/4056 Landfill (SWMU 7.1)	Old Conservation Yard (SWMU 7.4)
C14-C20 (Diesel Range)	100 mg/kg	180 mg/kg	160-1200 mg/kg
C20-C30 (Lubricant Oil Range)	100 mg/kg	820 mg/kg	110-3500 mg/kg
Oil and Grease	100 mg/kg	500-1100 mg/kg	N/A
Copper	68.6 mg/kg	73-93 mg/kg	N/A
Lead	19.9 mg/kg	22-23 mg/kg	N/A

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7. ENVIRONMENTAL MONITORING PROGRAM QUALITY CONTROL

This section describes the quality assurance (QA) elements incorporated into the Rocketdyne radiological analysis program. The following elements of quality control are used for the Rocketdyne program:

1. Reagent Quality—Certified grade counting gas is used.

2. Laboratory Ventilation—Room air supply is controlled to minimize temperature variance and dust incursion.

3. Laboratory Contamination—Periodic laboratory contamination surveys for fixed and removable surface contamination are performed. Areas are cleaned routinely and decontaminated when necessary.

4. Control Charts—Background and reference source control charts for counting equipment are maintained to evaluate stability and response characteristics.

5. Laboratory Intercomparisons—Rocketdyne participates in the DOE EML-QAP.

6. Calibration Standards—Counting standard radioactivity values are traceable to NIST primary standards.

7. Co-location of State DHS thermoluminescent dosimeters.

7.1 PROCEDURES

Procedures followed include those for selection, collection, packaging, shipping, and handling of samples for off-site analysis; sample preparation and analysis; the use of radioactive reference standards; calibration methods and instrument QA; and data evaluation and reporting.

7.2 RECORDS

Records generally cover the following processes: field sample collection and laboratory identification coding; sample preparation method; radioactivity measurements (counting) of samples, instrument backgrounds, and analytical blanks; and data reduction and verification.

Quality control records for laboratory counting systems include the results of measurements of radioactive check sources, calibration sources, backgrounds, and blanks, as well as a complete record of all maintenance and service.

Records relating to overall laboratory performance include the results of analysis of inter-laboratory cross-check samples and other quality control analyses; use of standard (radioactive) reference sources; and calibration of analytical balances.

7.3 QUALITY ASSURANCE

Rocketdyne participates in the DOE Quality Assessment Program (QAP) operated by the Environmental Measurements Laboratory (EML) in New York for radiological analyses. During 2000, two sets of samples were distributed: QAP-52 and QAP-53 [DOE 2000a; DOE 2000b]. In 1994, EML analyzed the QAP historical data for air filter, soil, vegetation, and water samples from 1982 through 1992 to generate representative control limits for the performance evaluation of analytical services. The individual data values reported by the participating laboratories were normalized to the EML reference value, and the normalized values were grouped into percentiles. The middle 70% of all historical reported values (from the 15th to 85th percentile) was established as Acceptable and the next 10% on both sides of the 70%—the 5th to 15th and 85th to 95th percentiles—as acceptable with Warning. Results outside this 90% band were considered not acceptable.

Rocketdyne and DOE use several laboratories for environmental sample analyses. Results of Rocketdyne, California DHS Sanitation and Radiation Laboratory, Oak Ridge Institute for Science and Education (ORISE), three of the vendor laboratories, and the average for all laboratories that participated in the QAP program are shown in Figure 7-1 for QAP-52 and QAP-53. Although these comparisons involve sample types, geometries, and analyses that are not part of the routine procedures at the Rocketdyne laboratory, historical review of the Rocketdyne results and those of the other laboratories has generally shown a similar level of quality.

Davi Laboratories, Environmental Associates (Pinole, CA) does not participate in the DOE QAP program, however, in 2000, they participated in another inter-laboratory comparison blind test controlled by Environmental Resource Associates. All of their analyses results were 100% acceptable.

All quantitative environmental air samples for the site are analyzed by outside laboratories. For the present report, air and effluent filter samples were analyzed by Teledyne-Brown Engineering Environmental Services (Westwood, NJ), soil samples were analyzed by Severn Trent St. Louis Laboratory, surface water samples were analyzed by Davi Laboratory and Thermo Retec (Richmond, CA), and groundwater samples were analyzed by Thermo Retec (Richmond, CA).

SHEA's Technical and Analytical Services (TAS) team supports Radiation Safety in the following QA capacities. A TAS team member accompanies the Radiation Safety and Quality representatives as part of the team that conducts surveys of vendor laboratories and that person focuses on the chemical analyses. The SSFL Analytical Laboratory is a State of California Certified environmental laboratory and performs a limited number of environmental analyses in house. Most environmental analyses in support of SHEA programs are performed by certified contract laboratories. These laboratories are monitored for quality and compliance by the Technical and Analytical Services team. The SSFL Analytical Chemistry Lab's Quality Assurance Program provides a means by which the integrity of data can be validated. Audit and validation services are provided to the Radiation Safety team when required.

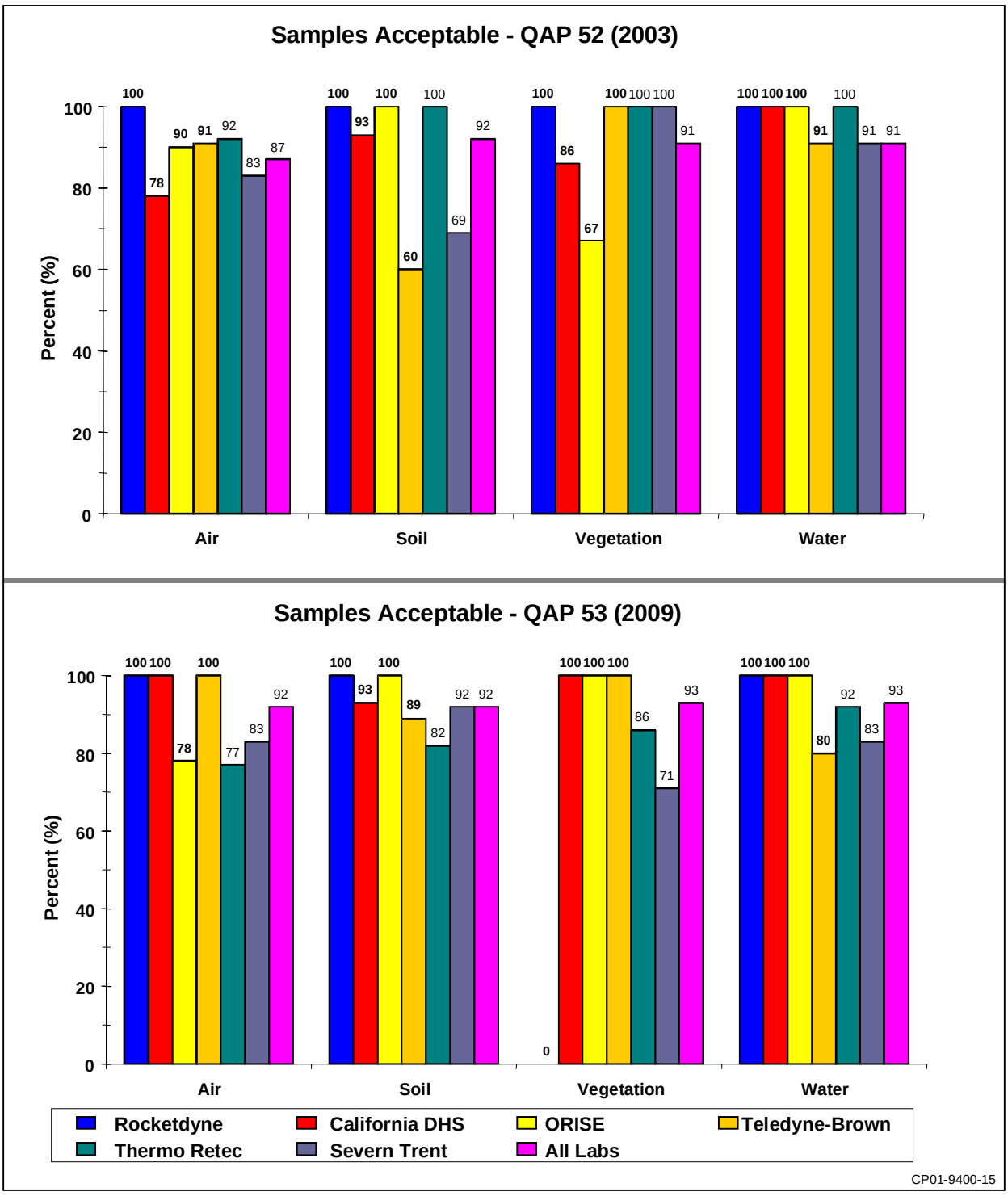

Figure 7-1. Quality Assessment Program Results for QAP-52 and QAP-53

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8. REFERENCES

Atkinson, R., 1996. *ETEC Waste Minimization and Pollution Prevention Awareness Plan*. ETEC Document GEN-AN-0037, Rev. A. The Boeing Company, Rocketdyne, Canoga Park, CA.

DHS (State of California Department of Health Services), 1998. Letter from Gerard Wong (DHS) to Phil Rutherford, Untitled (Release of FSDF for unrestricted use). 003463RC. State of California Department of Health Services, Sacramento, CA.

DHS (State of California Department of Health Services), 2000. Letter from D. Bunn (DHS) to D. Sutherland (DOE) Dated February 14, 2000: Complaint Concerning the Rocketdyne Trailers. State of California Department of Health Services, Sacramento, CA.

DOE (U.S. Department of Energy), 1990. *General Environmental Protection Program Requirements*. DOE Order 5400.1. U.S. Department of Energy. Washington, D.C.

DOE (U.S. Department of Energy), 1993. *Radiation Protection of the Public and the Environment*. DOE Order 5400.5. U.S. Department of Energy. Washington, D.C.

EPA (U.S. Environmental Protection Agency), 1992. *Users Guide for CAP88-PC, Version 1*. EPA/402-B-92-001. U.S. Environmental Protection Agency, Office of Radiation Programs. Las Vegas, NV.

GRC (Groundwater Resources Consultants, Inc.), 2000. *Results of Soil Sampling and Analysis - Shandon High School*. 8640M-416. Groundwater Resources Consultants, Inc. Tucson, AZ. June 16, 2000.

HA (Haley & Aldrich), 2001. *Annual Groundwater Monitoring Report, Santa Susana Field Laboratory, 2000*. Haley & Aldrich. Tucson, AZ. February 28, 2001.

Liddy, P. M., 2000a. *Area 4020, MARSSIM Final Survey Report*. Document RS-00010. The Boeing Company, Rocketdyne, Canoga Park, CA.

Liddy, P., 2000b. *17th Street Drainage Area, Final Status Survey*. Document RS-00009, Rev. A, March 2000.

Liddy, P. M., 2001. *Building 4133 Radiation Survey Report*. Document RS-00011. The Boeing Company, Rocketdyne, Canoga Park, CA (To be published).

Oldenkamp, R. D. and J. C. Mills, 1991. *Nuclear Operations at Rockwell's Santa Susana Field Laboratory - A Factual Perspective*. Rockwell Document N001ER000017, Rev. C. Canoga Park, CA.

ORISE, 2000a. *Verification Survey for the Land Area Formally supporting the Hot Laboratory (4020), Santa Susana Field laboratory, The Boeing Company, Ventura County, California*. ORISE 2000-1524, December 2000.

ORISE, 2000b. *Verification Survey of Building 4059 (Phase I), Santa Susana Field laboratory, The Boeing Company, Ventura County, California*. ORISE 2000-1523, December 2000.

ORISE, 2000c. *Verification Survey of the 17th Street Drainage Area, Santa Susana Field Laboratory, The Boeing Company, Ventura County, California*. ORISE 00-0576, April 2000.

ORISE 2000d. Verification Survey of Building 4133, Santa Susana Field Laboratory, The Boeing Company, Ventura County, California. ORISE 00-0577, April 2000.

APPENDIX A
ACRONYMS

AI	Atomics International
ALARA	As Low As Reasonably Achievable
AFP	Air Force Plant
ANL	Argonne National Laboratory
AOC	Areas of Concern
ASER	Annual Site Environmental Report
ASL	Above Sea Level
ATSDR	Agency for Toxic Substances and Disease Registry
BaF	bioaccumulation factor
Be	Beryllium
CAA	Clean Air Act
CAL/OSHA	California Occupational Safety and Health Administration
$CaSO_4$	calcium sulfate
CEQA	California Environmental Quality Act
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
Co	Cobalt
CRWQCB	California Regional Water Quality Control Board
Cs	Cesium
CWA	Clean Water Act
CX	Categorical Exclusion
D&D	Decontamination and Decommissioning
DCG	Derived Concentration Guide
DHS-EMB	California Department of Health Servics - Environmental Management Branch
DHS/RHB	Department of Health Services/Radiologic Health Branch
DOD	Department of Defense
DOE	Department of Energy
DTSC	Cal-EPA Department of Toxic Substances Control
EA	Environmental Assessment
EIS	Environmental Impact Statement
EML	Environmental Measurements Laboratory
EP	Environmental Protection
EPA	Environmental Protection Agency
EPA/ORIA	EPA - Office of Radiation and Indoor Air

ER	Environmental Remediation
ETEC	Energy Technology Engineering Center
ETS	Extraction and Treatment Center
Eu	Europium
FFCA	Federal Facilities Compliance Act
FONSI	Finding of No Significant Impact
FSDF	Former Sodium Disposal Facility
GRC	Groundwater Resources Consultants, Inc. (Tucson, AZ) (now Haley & Aldrica)
GSA	General Service Administration
HEPA	High-Efficiency Particulate Air
HPGe	High-Purity Germanium (Detector)
HWMF	Hazardous Waste Management Facility
ISMS	Integrated Safety Management System
K	potassium
LLNL	Lawrence Livermore National Laboratory
LLW	Low Level Waste
LMDL	Liquid Metal Development Laboratory
MARSSIM	Multi-Agency Radiation Survey and Site Investigation Manual
MCA	Multichannel Analyzer
MCL	Maximum Contamination Level
MDA	Minimum Detectable Activity
MEI	Maximally Exposed Individual
MLLW	Mixed Low-level Waste
MTRU	Mixed Transuranic Waste
NASA	National Aeronautics and Space Administration
ND	Not Detected
NEPA	National Environmental Policy Act
NESHAPs	National Emission Standards for Hazardous Air Pollutants
NIST	National Institute of Standards and Technology
NOD	Notice of Deficiency
NOI	Notice of Intent
NOV	Notice of Violation
NPDES	National Pollutant Discharge Elimination System
NRC	Nuclear Regulatory Commission
NSPS	New Source Performance Standard
OCY	Old Conservation Yard
ODS	Ozone Depleting Substance

ORAU	Oak Ridge Associated Universities
ORISE	Oak Ridge Institute for Science and Education
ORNL	Oak Ridge National Laboratory
Pb	Lead
PCB	Polychlorinated Piphenyl
PCE	Perchloroethene
Po	Polonium
P/O	Permit to Operate
Pu	Plutonium
QA	Quality Assurance
QAP	Quality Assessment Program
R&D	Research and Development
RCRA	Resource Conservation and Recovery Act
RFA	RCRA Facility Assessment
RFI	RCRA Facility Investigation
RMHF	Radioactive Materials Handling Facility
Rn	Radon
ROD	Record of Decision
RS	Radiation Safety
RWQCB	Regional Water Quality Control Board
SARA	Superfund Amendments and Reauthorization Act
SCTI	Sodium Component Test Installation
SCTL	Small Component Test Loop
SHEA	Safety, Health & Environmental Affairs
SIPs	State Implementation Plans
S&M	Surveillance and Maintenance
SNAP	Systems for Nuclear Auxiliary Power
SPCC	Spill Prevention Control and Countermeasure
SPTF	Sodium Pump Test Facility
Sr	Strontium
SRAM	Standardized Risk Assessment Methodology
SRE	Sodium Reactor Experiment
SSFL	Santa Susana Field Laboratory
SWPPP	Storm Water Pollution Prevention Plan
STP	Sewage Treatment Plant or Site Treatment Plan
SWMU	Solid Waste Management Unit
TCE	Trichloroethylene
TEDE	Total Effective Dose Equivalent

Th	Thorium
TLD	Thermoluminescent Dosimeter
TRU	Transuranic
U	Uranium
UCLA	University of California at Los Angeles
UST	Underground Storage Tank
VCAPCD	Ventura County Air Pollution Control District
VCEHD	Ventura County Environmental Health Division
WPAA	Work Plan Addendum Amendment
WVN	Water Vapor Nitrogen

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Site Environmental Report Reader Survey--2000

To Our Readers:

The Annual Site Environmental Report publishes the results of environmental monitoring in support of DOE-sponsored programs at Rocketdyne's Santa Susana Field Laboratory, and documents our compliance with federal, state, and local environmental regulations. In providing this information, our goal is to give our readership—regulators, scientists, and the public—a clear understanding of our environmental activities, the methods we use, how we can be sure our results are accurate, the status of our programs, and significant issues affecting our programs.

It is important that the information we provide is easily understood, of interest, and communicates Rocketdyne's efforts to protect human health and minimize our impact on the environment. We would like to know from you whether we are successful in achieving these goals. Your comments are appreciated and will help us to improve our communications.

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